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ATTENTION-DEFICIT/HYPERACTIVITY DISORDER (ADHD) SYMPTOMS AND ACADEMIC PERFORMANCE AMONG UNDERGRADUATES: THE COMBINED INFLUENCE OF DEFICIENCIES IN ACADEMIC COPING AND EXECUTIVE FUNCTIONING

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by

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DEDICATION

This dissertation is dedicated to both students with Attention-Deficit/Hyperactivity Disorder (ADHD) and other Learning Disabilities working in pursuit of their scholastic goals, and the scientists, practitioners, and educators helping them to meet their potentials.

"Never, never, never, never give up."

- Winston Churchill

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Current findings indicate that the symptom clusters of inattention and hyperactivity-impulsivity, the primary behavioral characteristics of Attention-Deficit/Hyperactivity Disorder (ADHD), serve as risk factors for reduced academic performance in postsecondary educational settings. The proposed investigation is designed to clarify the extent and mechanisms through which these associated symptoms clusters predict reduced academic performance in an undergraduate sample. This investigation tests four hypotheses: (a) ADHD symptoms predict inversely undergraduates' academic performance; (b) deficiencies in academic coping partially mediate the relationship between undergraduates' ADHD symptoms and academic performance; (c) deficiencies in undergraduates' executive functioning partially

mediate the association between students' ADHD symptoms and their academic coping; and (d) the predictive association between students' ADHD symptoms and academic performance is more fully explained by their level of academic coping and executive functioning. To achieve these goals, 111 undergraduates from The University of Texas with variable levels of ADHD symptoms were recruited for participation in this study. Participants' academic performance (i.e., concurrent and cumulative semester grade point average, number of problem credit hours, and number of completed credit hours) will be compared to their level of self-reported ADHD symptoms (i.e., current and childhood ADHD symptoms). The hypothesized mediating effect of academic coping on this relationship was evaluated using two questionnaires of academic coping that separately assess students' general academic coping strategies and more specific academic coping behaviors. Further, the anticipated mediating effect of executive functioning on the relation between ADHD symptoms and academic coping was investigated using two neuropsychological tests of attentional control and planful problem solving. Results did not support the proposed model although several study hypotheses received partial support. A data-derived alternative explanatory model is presented and clinical implications are discussed.

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CHAPTER 1: INTRODUCTION TO ADHD

The purpose of this chapter is to present an overview of the nature, proposed etiology, and empirical outcomes associated with ADHD. The traditional focus on childhood symptoms of ADHD, the complex physiological and neurochemical risk factors associated with ADHD, and the emotional, interpersonal, and academic risk for patients with the disorder serve to provide a context for understanding what variables might help to explain the patterns of academic performance among college students with ADHD. The present chapter ends with a brief summary of the rationale for conducting an investigation of ADHD behavioral symptoms and the combined influences of academic coping and executive functioning among undergraduates; the topic of the second chapter. The relevance of a dimensional approach to understanding academic risk for individuals with ADHD behavioral symptoms; and the need for a broader conceptual understanding of ADHD and academic risk will be emphasized to provide a backdrop for understanding the role of these two variables thought to affect the academic performance of undergraduates with ADHD symptoms.

To provide such background, this chapter will address definitional issues with regard to the historical and contemporary nomenclature associated with ADHD. Problems with this taxonomy will also be presented briefly, before transitioning to etiological variables thought to subserve the manifestation of ADHD. After an elaboration of the neuroanatomical, neurophysiological, and neurochemical variables thought to account for the disorder, a discussion of the long-term effects of these variables will ensue. The chapter reviews the manifestation of ADHD symptoms and

impairment in adulthood, as well as the developmentally consistent problems with psychiatric conditions, interpersonal strife, and problems in scholastic and occupational domains that are so often associated with the disorder. A developmental perspective is taken in which these problem domains are presented from childhood through adulthood with an emphasis on understanding the relation of academic performance among undergraduates with ADHD symptoms.

DEFINITIONAL ISSUES

Historical and Contemporary Nomenclature

Although reports of hyperactive and disruptive children exist as early as the 1800s (Anastopoulos & Shelton, 2001), the scientific investigation of ADHD did not begin until Still (1902) identified children with symptom-clusters of inattention, overactivity, and impulsivity. Subsequent investigators attributed neurological dysfunction to these children throughout the 20th Century. This neurological view was reflected in various authors' diagnostic terminology. For example, authors referred to children with these clusters of symptoms as suffering from: Organic Driveness (Kahn & Cohen, 1934), Minimal Brain Damage Syndrome (Strauss & Kepart, 1955), and Minimal Brain Dysfunction (Clements & Peters, 1962). Even within the evolution of the standard nomenclature of the psychiatric profession, such as in the second edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-II*; APA, 1968), children were diagnosed with labels such as Hyperkinetic Reaction of Childhood.

Some years later, in contrast, the third edition of this manual (*DSM-III*; APA, 1980) incorporated systematic research with an emphasis on attentional dysfunction (Barkley, 1990). The authors of this version adopted the diagnostic label Attention Deficit Disorder (ADD) with (+H) or without (-H) hyperactivity (APA, 1980). Because there was little scientific evidence to suggest that differences exist between ADD/+H and ADD/-H children, the revised edition (*DSM-III-R*; APA, 1987) used the term ADD and did not differentiate between patients with or without hyperactive-impulsive symptoms (Barkley, 1990).

The fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV*; APA, 1994) incorporated more recent evidence (Carlson, 1986) that supported the notion that different subtypes exist among children with the disorder (see Table 1.). Although the syndrome was labeled Attention-Deficit/Hyperactivity Disorder (ADHD), this edition incorporated a system of behavioral sub-typing for children who display functionally impairing symptom-clusters of inattention, hyperactivity, or impulsivity. Consistent with the a-theoretical approach of the manual's authors, the symptoms of ADHD were designed to address behavioral problems in children. Across development, however, these childhood behaviors show discontinuity with the behaviors typically displayed by adults with the disorder (Steinhausen, Dreschler, Foldenyi, et al., 2003; Weiss & Murray, 2003; Willoughby, 2003).

Overall, symptoms of inattention are relatively consistent across development (Teeter, 1998). For example, in children deficient sustained attention typically manifests by frequently making careless errors, failing to listen or follow through on instructions,

having difficulty with planning and organization, as well as exhibiting reluctance to exert sustained mental effort (APA, 1994). Similarly, adults with the disorder typically manifest inattentive symptoms (Millstein, Wilens, & Biederman, 1997) that take the form of frequently misplacing things, being unable to complete uninteresting tasks, and they also frequently fail to follow through on other people's instructions. Adults with ADHD also exhibit problems with planning and organization, tend to procrastinate, and complain of having problems with memory (Millstein, Wilens, & Biederman, 1997; Weiss, Hechtman, & Weiss, 1999).

Unlike the symptoms of inattention and distractibility, symptoms of hyperactivity and impulsivity often vary from childhood to adulthood (Weiss, Hechtman, & Weiss, 1999). Whereas children with ADHD will often fidget, inappropriately run about or leave their seat in classroom settings, and usually appear to be "on the go" (APA, 1994), adults with ADHD exhibit less global motor output (Hill & Schoener, 1996). Although some adults with ADHD display fidgetiness, most will report only a subjective sense of needing to be on the go or a preference for doing things at a frenetic pace (Weiss, Hechtman, & Weiss, 1999).

Impulsive symptoms likewise differ across development. Although symptoms like interrupting others, exhibiting impatience, and verbally intruding on others are developmentally consistent, adults with ADHD can generate more serious consequences for themselves by making impulsive decisions (Weiss, Hechtman, & Weiss, 1999). Further, just as children show social skills deficits (often involving problems with impulsivity) and exhibit developmentally immature behavior (Cunningham & Seigel,

1987; Grenel, Glass, & Katz, 1987), so too do adults with the disorder (Taylor, Chadwick, Heptinstall, & Danckaerts, 1996). In like manner, impulsive actions by adults with the syndrome can lead to more serious interpersonal and relational difficulties in their personal- and work-lives.

The contemporary taxonomy for ADHD requires the presence of six or more symptoms of inattention and/or hyperactivity-impulsivity. Children exhibiting inattention symptoms only are classified as Primarily Inattentive (PI), whereas those having widespread symptoms of hyperactivity-impulsivity only are categorized as Primarily Hyperactive-Impulsive (HI). Children demonstrating both symptom sets are diagnosed with ADHD Combined Type (CT). The *DSM-IV* (APA, 1994) also requires that symptoms be present for at least six months, begin before the age of seven-years, and are not due to other psychiatric or medical conditions. When individuals diagnosed with ADHD in childhood mature and retain their clinically impairing symptoms of the disorder, but below full diagnostic threshold, they are classified as ADHD "In Partial Remission" (APA, 1994).

Problems with the Contemporary Taxonomy

Although the evolution of this taxonomy is consistent with advances in the scientific understanding of the disorder, it also presents problems on a number of levels. Temporally, the fluctuating status of ADHD criteria obscures matters when investigators attempt to compare the results from studies conducted over the past three decades. Other problems at the level of the behavioral symptoms in children have been stressed in the literature. Power, Costigan, Leff, et al. (2001) have pointed out that even though not all of

the items pertaining to inattention and hyperactivity were equal in relation to their ability to predict ADHD in the *DSM-IV* (APA, 1994) field-trial studies (Frick, Lahey, Applegate, et al., 1994), the *DSM-IV* (APA, 1994) criteria give equal weight to each symptom in making diagnostic decisions. Numerous authors have also criticized the current *DSM-IV* (APA, 1994) taxonomy for failing to make the criteria norm-referenced, enabling the evaluation of a given patient along a continuum in relation to a sample of their age-appropriate peers (Biederman, Faraone, Spencer, et al., 1993; Chen, Faraone, Biederman, & Tsuang, 1994; Eiraldi, Power, Karustis, & Goldstein, 2000; Power, Costigan, Leff, et al., 2001; Power & Eiraldi, 1998; 2000; Reid & Maag, 1994).

These problems are not limited to children with ADHD, for there debate exists related to the behavioral diagnostic criteria of ADHD in adulthood. At a basic level, the *DSM-IV* (APA, 1994) criteria are gauged for the behaviors of children, not adults. This engenders unstandardized extrapolation of the childhood criteria when applied to adults suspected of having ADHD. Further, because adults with ADHD show disproportionate levels of inattention (Millstein, Wilens, & Biderman, 1997), the diagnostic symptoms of ADHD may currently fail to sufficiently represent the heterotypic continuity of this cluster of symptoms in adults with the disorder. This in effect parallels Power and colleagues' (2001) complaint with regard to the equal diagnostic weight given to ADHD criteria for children. The issue surrounding the lack of norm-referenced ADHD criteria is strongly evident in the adult ADHD literature (Barkley & Murphy, 1996a, 1996b, 1998). Several authors have criticized the *DSM-IV* (APA, 1994) behavioral diagnostic criteria for being too restrictive for the categorical diagnosis of adult ADHD. Significant

evidence provides support for this concern. On the basis of self-ratings of ADHD symptoms in a large community sample, Murphy and Barkley (1996b) have reported that the *DSM-IV* (APA, 1994) behavioral diagnostic criteria are indeed excessive, failing to correspond with the significant proportion of individuals who report clinically significant impairment. Findings of this sort imply that adults who retain the diagnosis of ADHD represent a much more severe sample of the ADHD population, with stricter behavioral criteria being used relative to those of children with the disorder. In spite of these problems, significant advances have been made in understanding the nature of ADHD from an etiological vantage point, and are the topic of the next section.

ETIOLOGICAL MODELS OF ADHD

Neuroanatomical and Neurophysiological Models

Recent neuroimaging techniques enable researchers to reveal patterns of differential neuroanatomical structure and function in the brains of patients with ADHD. This neurobiological domain of research has primarily involved the fronto-striatal system, which is responsible for adaptive responses to environmental situations. This intricate matrix of cortical and subcortical nuclei is responsible for the collective operation of attentional control, or the product of working memory and processing speed functions which mediate behavioral output (Lichter & Cummings, 2001). In their summary of the neuroimaging findings related to ADHD, Giedd, Blumenthal, Molloy, and Castellanos (2001) have concluded that the brains of patients with the disorder consistently demonstrate having aberrant frontal lobes, basal ganglia, corpus callosa, and

cerebella. Each of these regions, with a disproportionate influence by the prefrontal lobes, affects internally guided behavior (Wagner, Maril, Bjork, & Shacter, 2001).

In addition, other authors have identified loci among these global regions that differ structurally from the brains' of controls. For example, Hesslinger, Tebartz van Elst, Mochan, and Ebert (2003) have reported that the left orbitofrontal cortex, a specific sub-region of the frontal lobes, differentiates patients with ADHD from controls. This region is the primary locus associated with attentional control (Barkley, 1997, 1998; Konishi, Kawazu, Uchida, et al., 1999; Nathaniel-James, Fetcher, & Frith, 1997).

Additional research findings have also implicated functional deficiencies related to these cortical and sub-cortical loci. Along the developmental continuum patients with ADHD consistently show dysfunctional neural circuitry involving the frontal lobes, cingulate cortex, striatum, and cerebella (Ernst, Liebenauer, King, et al., 1994; Enrst, Zametkin, Matochik et al., 1994, 1999; Giedd, Blumenthal, Molloy, & Castellanos, 2001; Lou, Hendrikson, Bruhn, et al., 1989; Zametkin, Liebenauer, Fitzgerald, et al., 1993; Zametkin, Nordahl, Gross, et al., 1990). Substantial evidence highlights the respective roles these regions play in regulating: (a) attentional control (i.e., working memory and processing speed) (Bunge, Oschsner, Desmond, et al., 2001; Geschwind & Iacoboni, 1999); (b) learning and memory (Knowlton, 2002); and (c) sequencing and coordinating behavioral output (Doyon & Ungerleider, 2002).

Neurochemical Models

Individuals with ADHD also demonstrate having dysregulated neurochemical circuits across the lifespan (Matochik, Nordahl, Gross, et al., 1993). Catecholamines are a

class of neurotransmitters including dopamine, norepinephrine, and serotonin. The Catecholamine Hypothesis posits that an insufficient quantity of catecholamines is available in the brains of individuals with ADHD; and this neurochemical abnormality is responsible for the cognitive and behavioral dysregulation found in those with the syndrome (Solanto, 2000).

Each of these neurotransmitters produces partially independent effects on brain and behavior. This feature of the hypothesis makes it a powerful theoretical model to account mechanistically for the heterogeneity so often found in the syndrome. For example, norepinephrine is thought to mediate signal-to-noise discrimination (Berridge, 1993; Hasselmo & Linster, 1999), attention and arousal states (Feifel, 1999), as well as memory (Gloor, 1997). The role of this neurotransmitter in the etiology of ADHD is so heavily regarded that some investigators have gone so far as to describe ADHD as a "noradrenergic disorder" (e.g., Biederman & Spencer, 1999).

Alternative routes to deficiencies in executive functioning also stem from other catecholamine irregularities. Another catecholamine, serotonin, is known to exert an inhibitory effect during regulation. This single neurotransmitter increases impulse control and frustration tolerance (Robert, Aubin-Brunet, Darcourt, 1999), elevates mood, and enhances memory (Swartz, 1999). Thus, the single neurotransmitter affects broad emotional and motivational systems that are dysregulated in patients with ADHD.

In contrast dopamine, a third exemplar of the catecholamines, is known to affect motor, behavioral, and reward circuits (Swartz, 1999). This neurotransmitter system has sparked significant interest within the ADHD research community, because the most

effective psychopharmacological treatments for the disorder (methylphenidate and amphetamine) act as indirect dopamine agonists (Wender, Wolf, & Wasserstein, 2001). Like dopamine itself, these interventions increase voluntary control of motor function, reduce responsiveness to externally dependent reward states, and increase motivation (Solanto, 2000; Swartz, 1999).

Each of these neurotransmitters differentiates patients with ADHD from controls and mediates several aspects of executive functioning. For example, Hanna et al. (1995) have reported that dopamine and norepinephrine levels differ among youth with ADHD relative to controls. Similarly, Oades (2002) has reported that measures of working memory and processing speed are positively associated with norepinephrine levels, but negatively related to levels of serotonin. These findings are not unique, as others have reported similar correspondences between catecholamine metabolism and measures of attentional processing (e.g., Llorente et al., 2000). These interactive features of the catecholamines draw further attention to the complexity of these systems, and add depth to the manner in which the heterogeneity in ADHD may be understood.

The Catecholamine Hypothesis receives further support from studies following a different methodological approach. These investigations have involved measuring the level of psychostimulant response among individuals with ADHD. Reimherr, Wender, Ebert and Wood (1984) have reported lower levels of metabolized dopamine in psychostimulant responders relative to non-responders with ADHD, or Normative controls. In like manner, Castellanos and colleagues (1995, 1996) have found that the same dopamine metabolite is the best predictor of psychostimulant response. In fact,

these authors have reported that this variable accounts for approximately 50% of symptomatic variation.

Taking another approach, authors such as Wood, Reimherr, and Wender (1983) have made use of two agents known to prevent the metabolism of dopamine. These authors have reported that this caused a marked reduction in symptoms for 60% of patients with ADHD. These findings not only implicate the multi-systemic etiology of this heterogeneous disorder (Biederman & Spencer, 1999; Faraone & Biederman, 1998), but also suggest that psychopharmacological and behavioral treatment interventions must be specifically honed to the neurocircuitry and environmental context of the individual patient with ADHD.

BROADER PROBLEMS ASSOCIATED WITH ADHD

Recent retrospective and prospective-longitudinal studies have provided strong support for the relative heterotypic continuity of behavioral dysfunction, as children with ADHD become adolescents and adults (Mannuza & Klein, 2000; Mannuzza, Gittleman-Klein, Bessler, et al., 1993; Weiss & Hechtman, 1993; Willoughby, 2003). Although the behavioral symptom clusters of inattention and hyperactivity-impulsivity do not remit for many patients with ADHD, investigators have disagreed about the true prevalence of ADHD in adulthood. Barkley, Fischer, Smallish and Fletcher (2002) have stressed that the differing prevalence estimates of ADHD in adulthood are due to the diagnostic variability of the disorder (i.e., with significant change in the conceptual and behavioral diagnostic criteria used to define the syndrome), and whether the research question of

interest has concerned the whole syndrome versus persistence of individual ADHD symptoms. These authors have also identified variation in prevalence estimates being due to the reporting source of the ADHD symptoms.

Barkley, Fischer, Smallish and Fletcher (2002) cited a fifteen-year prospective investigation of 148 children with ADHD as an example. In this longitudinal report, only three percent evidenced the adult ADHD syndrome according to *DSM-III-R* (APA, 1987) behavioral diagnostic criteria. These investigators pointed out that diagnostic status in this investigation, however, was likely an underestimate of the disorder's true prevalence as adults with ADHD have been shown to underreport their symptoms (Robin & Vandermay, 1996; Smith, Pelham, Gnagy, et al., 2000; Spencer, Biederman, Wilens, & Faraone, 1994; Zucker, Morris, & Ingram, 2002). Critically, results differed quite substantially when diagnostic status was calculated other ways. When syndrome prevalence was calculated on the basis of behavioral symptoms at the ninety-third percentile of controls, twenty-five percent of the clinical cohort met full behavioral criteria for the disorder. Diagnostic status incorporating parent report brought the syndrome prevalence to forty-two percent in adulthood. Barkley (1998) has asserted that such methodological constraints likely account for a large proportion of the variability in prevalence estimates. Indeed, these estimates range from four to eighty percent depending upon the study length and definition of persistence (Barkley, 1998).

These methodological parameters are important when other studies targeting the prevalence of adult ADHD are considered. For example, in their longitudinal study Biederman, Mick, and Faraone (2000) reported that thirty-eight percent of their child-

onset ADHD cohort met full criteria for ADHD in adulthood. These authors reported that seventy-two percent of their adult cohort had a third of the behavioral symptoms required for a diagnosis of ADHD. In stark contrast to the long held view that ADHD remits by adulthood (Hill & Schoener, 1996), an astonishing ninety percent of Biederman and colleagues' sample reported having clinically significant impairment from their ADHD symptoms. These outcomes are consistent with meta-analyses of over 1,700 adults with childhood-onset ADHD that have demonstrated that approximately forty percent of patients continue to suffer from ADHD in adulthood, with between four and five percent of the general population being afflicted (Spencer, Biederman, Wilens, & Faraone, 1994). Further support for these estimates comes from studies of larger community and cross-national samples, which provide similar prevalence estimates (DuPaul, Schaughency, Weyandt, et al., 2001; Heiligenstein, Conyers, Levy, et al., 1998; Murphy & Barkley, 1995, 1996a, 1996b; Rassmussen, Todd, Neuman, et al., 2002).

ADHD and Risk for Emotional Dysfunction

The contemporary ADHD literature identifies an array of developmental difficulties with affective regulation and psychiatric co-morbidity (Murphy, Barkley, & Bush, 2002), which is likely to negatively influence academic success in this population. Early on, children with the disorder display poor frustration tolerance with less delayed gratification (Sonuga-Barke, Taylor, & Hepinstall, 1992; Sonuga-Barke, Taylor, Sembi, & Smith, 1992), and begin to internalize an external locus of control (Lufi & Parish-Plass, 1995). The development of an external locus of control is particularly pernicious in the academic realm (Wong, Harris, Graham, & Butler, 2003), as this variable has been

shown to predict lower ratings of personal self-efficacy (Endler & Kokovski, 2000). These behavioral patterns put these children at risk for developing serious psychopathology. In fact, clinic-referred and community-based studies have yielded elevated rates of Oppositional-Defiant Disorder and Conduct Disorder in children with ADHD relative to controls (August, Realmuto, MacDonald, et al., 1996; Pelham, Gnagy, Greenslade, & Milich, 1992). These comorbid conditions are not limited to externalizing syndromes (Power, Costigan, & Eiraldi, 2004), however, as children with ADHD are also at significant risk for developing anxiety (August et al., 1996; Jensen, Martin, & Cantwell, 1997) or mood disorders (August et al., 1996; Biederman, Newcorn, & Sprich, 1991).

This pattern of findings does not change substantially for youth with ADHD as they enter and confront the challenges of adolescence. Evidence in support of this proposition comes from prospective-longitudinal and retrospective studies, which suggests that adolescents with ADHD have disproportionately low self-esteem (Hoy, Weiss, Minde, & Cohen, 1978; Weiss, Minde, Werry, et al., 1971). The prevalence of comorbid conditions in adolescence does not decline. Rather, with new life transitions and the augmented demands intrinsic to this life stage, adolescents with ADHD show a seventy-five percent chance of developing a comorbid condition (McGee, Williams, & Feehan, 1992).

As adolescents with ADHD become adults, their prognosis does not appreciably improve (Mannuzza & Klein, 1999; Weiss, Hechtman, Milroy, & Perlman, 1985). In fact, adults with ADHD also continue to exhibit disproportionately low frustration tolerance

(Murphy, 1995). In a manner consistent with their younger counterparts, adults with ADHD continue to show signs of low self-esteem (Murphy, 1995; Ratey, Greenberg, Bemporad, & Lindem., 1992). Adults with the disorder also continue to show high rates of psychiatric co-morbidity (Wilens, Biederman, & Spencer, 2002). Their insecure and irritable disposition precipitates more aggressive acting out (Hechtman & Weiss, 1993; Mannuza, Klein, Konig, & Giampino, 1989), and may put adults with ADHD at risk of developing more Axis II personality traits and higher levels of distress (May & Bos, 2000). Anxiety and mood disorders remain a problem for a disproportionate number of adults in this population (Biederman, Faraone, Spencer, et al., 1994; Downey, Stelson, Pomerleau, et al., 1997). Unfortunately, the clinical picture for these individuals is further complicated, as it often involves an elevated rate of alcohol and drug abuse or dependence (Downey et al., 1997; Heiligenstein, Guenther, Levy, et al., 1999; Mannuzza, Klein, Bessler, et al., 1993).

ADHD and Risk for Interpersonal Dysfunction

Just as the emotional disruption of children with ADHD often develops into age-appropriate difficulties in emotion regulation as adults, the social or interpersonal deficits in their lives (Wheeler & Carlson, 1994) show similar prognostic parallels. Importantly, academic success does not occur in a vacuum and is likely affected by a student's level of interpersonal functioning (Robin, 1998). A medley of negative interpersonal feedback loops has been identified in the ADHD literature. Broadly, these negative feedback loops typically involve ADHD children's maladaptive social deportment engendering negative responses from their interpersonal environment. From an early age children with ADHD

engage in more frequent noncompliant and negative behaviors than their peers (Campbell, 1995; Mash & Johnston, 1982). Not surprisingly, this behavior has been associated with less adaptive and more negative responses by the parents of these youth (Campbell, Breaux, Ewing, & Szumowski, 1986; Cunningham & Barkley, 1979). This state of affairs may further instigate interpersonal strife as such negative parent-child interactions put mothers and fathers of these children at risk for higher rates of marital discord and parental distress (Barkley, Murphy, & Kwasnik,, 1996a; Shelton, Barkley, Crosswait, et al., 1998). Data suggest that having a child with ADHD also elevates the risk of parental depression (Pelham & Lange, 1993) and other psychiatric conditions (Cantwell, 1972).

These reciprocally negative feedback loops also generalize outside of the home. Not only do children with ADHD behave in self-defeating ways with their peers, but they actively, although unknowingly, further reduce their own social status among their classmates (Cunningham & Siegel, 1987; Grenell, Glass, & Katz, 1987). Such fundamental indices of socially inappropriate behavior no doubt place adolescents and adults at serious risk of interpersonal problems in scholastic and non-scholastic arenas later in life. To date, it is clear that adolescents with ADHD display higher rates of social adjustment problems (Taylor, Chadwick, Heptinstall, & Danchaerts, 1996), and conflict with family members (Barkley, Anastopoulos, Guevremont, & Fletcher, 1992). What is more, they have fewer friends and engage in fewer social activities with same-aged peers (Barkley, Anastopoulos, Guevremont, & Fletcher, 1991).

It seems plausible that this attenuated social involvement may serve to slow the intra- and interpersonal maturation of these youth, as they become adults. Wilens, Biederman, and Spencer (2002) have provided evidence in support of this hypothesis, as adults with ADHD exhibit higher levels of immaturity, as well as fewer social assets than Normative peers. Sadly, the symptoms characteristic of the disorder may also result in greater relational instability as another associated negative outcome. The empirical literature appears to bear this out, as adults with ADHD have more separations, divorces, and remarriages than controls (Murphy & Barkley, 1996a). Although the emotional and social dysfunction characteristic of many individuals with ADHD is troublesome, the chronic patterns of reduced academic success may be the most pernicious effect associated with the disorder.

ACADEMIC PROBLEMS ASSOCIATED WITH ADHD

Data suggest that as children with ADHD attempt to embrace their role as students, they face disproportionate challenges at school. From an early age, approximately ten to fifty percent of children with ADHD develop comorbid Learning Disorders (Frick, Lahey, Kamphaus, et al., 1991; Tannock & Schacter, 1996). Moreover, these children often exhibit pronounced academic underachievement whether or not they are afflicted with a learning disability. Specifically, investigators report between twenty and fifty percent of children with ADHD perform well below expected levels (Frick et al., 1991). The schooling experience of many of these children is further compromised by the presence of other neurological conditions, such as Auditory Processing Disorders

(Riccio, Hynd, Cohen, et al., 1994). Exacerbating the risks for poor academic performance and outcome, these children may compete with a lower intellectual quotient (IQ) relative to their normative peers (McGee, Williams, Moffit, & Anderson, et al., 1989).

In the transition to adolescence, students with ADHD continue to be at risk for a host of scholastic difficulties. At the level of individual academic skills, these youth typically exhibit poorer reading skills (Fischer, Barkley, Edelbrock, & Smallish, 1993), and show lower levels of arithmetic achievement (Moffitt, 1990). Of serious concern, is the tendency of these adolescents to show even more problematic performance toward the middle and end of their scholastic tenure, at a time when their academic success is most critical for undergraduate matriculation. Barkley et al. (1991) and Barkley, Fischer, Edelbrock, and Smallish (1990) have reported that by adolescence, individuals with ADHD tend to receive lower grades, show greater utilization of special education services, and have a higher likelihood of repeating a grade. Not unlike their childhood experience, adolescents with ADHD also show elevated rates of Learning Disorders (Munir, Biederman, & Knee, 1987) and similarly perform more poorly on tests of intellectual capacity (Moffit, 1990). Relative to Normative controls, individuals with ADHD are suspended from school more frequently, drop out of high school at a higher rate, and more frequently pursue employment immediately after graduating, rather than pursue an undergraduate education (Klein & Mannuzza, 1991).

By adulthood, this population shows even greater scholastic deficits. Not only do they have between two and three years less of schooling (Mannuzza, Klein, Bonagura, et

al., 1991), but adults with ADHD have repeated more grades and received more frequent placement in remedial classes relative to controls (Biederman, Faraone, Spencer, et al., 1993; Biederman, Faraone, Spencer, et al., 1994). In fact, the data suggest that adults with ADHD are eleven-times more likely to have dropped out of high school than their Normative peers (Mannuzza, Klein, Bessler, et al., 1997). This pattern of underachievement continues into the postsecondary experience of those who are fortunate enough to matriculate into undergraduate institutions. Even for these privileged individuals, however, undergraduates with ADHD continue to show elevated rates of Learning Disorders, academic underachievement, and lower grade-point averages (Heiligenstein et al., 1998, 1999).

Undergraduates with ADHD also exhibit more significant academic problems and receive more frequent placement on academic probation (Heiligenstein et al., 1998, 1999). These clinically significant difficulties likely precipitate the fact that only twelve percent (five-fold fewer relative to the general population) of individuals with ADHD complete their undergraduate education, with only three percent (twelve-fold fewer relative to the general population) receiving a graduate degree (Mannuzza et al., 1997; National Center for Education Statistics, 1996). These enduring academic problems become especially significant when it is recognized that only a limited empirical literature exists that has targeted undergraduates with ADHD symptomatology.

CONCLUSION

The enduring rates of academic underachievement among undergraduates diagnosed with ADHD are cause for alarm. Recent investigations demonstrate that individuals diagnosed with ADHD and those with high levels of ADHD symptoms are at marked risk for academic underachievement. That sub-clinical symptomatology has long-term negative consequences suggests that a dimensional approach to understanding the disorder is needed. Further, academic underachievement by students with ADHD persists in the face of laudable governmental efforts to provide educational environments that better serve learning disabled students. Efforts date back to 1975, with the passage by Congress of the "Education of All Handicapped Children Act" (Public Law 94-142; Zigmond, 2003). Increased Congressional spending for learning disabled students continued with the "omnibus bill" of 1998 and the Higher Education Amendment of 1999 (Wolf, 2001). Yet, despite nearly three decades of special education and disability law, legislation specifically designed to help qualified students complete their postsecondary education, students with ADHD symptoms are not reaching their academic potential. The present study argues that legislation alone is not sufficient; what is needed is a broadened understanding of the syndrome that can shape and encourage research on new interventions for this population. Specifically, a fuller understanding of the mechanisms through which ADHD symptoms predict academic performance is needed in order to more adequately inform academic interventions in postsecondary educational settings.

Next, a discussion will follow concerning the possibility that academic coping serves to partially mediate the relationship between ADHD symptoms and academic performance.

CHAPTER 2: TOWARD A BROADER UNDERSTANDING

In this chapter it will be argued that the underlying role of deficiencies in executive functioning and academic coping can provide a fuller understanding of academic risk for students with ADHD symptoms and has the potential to lead to the development of more effective interventions for this population. Supporting research will be reviewed in the next section of this chapter, highlighting the importance and relation of these variables to one another. This discussion will provide a foundation for understanding the present study in which the formulation of an explanatory model will be proposed such that deficiencies in academic coping and executive functioning mediate the association between undergraduates' ADHD symptoms and their poor academic performance. An elaboration of this model and the study's hypotheses will be presented in the next chapter.

ADHD SYMPTOMS AND ACADEMIC PERFORMANCE: THE MEDIATING ROLE OF ACADEMIC COPING

In this section it will be argued that insufficient research has been conducted on the role that academic coping may play in determining the inverse relationship between ADHD symptoms and academic performance. This is surprising in that the broad literature on education, especially as applied to students with learning disabilities, suggests that academic coping may play a crucial role in determining academic success among students with ADHD symptoms. A brief review of the empirical literature on the

association between academic coping and academic performance will be presented. This will be followed by a review of research indicating that academic coping has strongly affected the performance of students with and without learning disabilities through the university level.

Academic Coping and Academic Performance: A Robust Relationship in the Education Literature

For many years it has been known that broadband variables such as general intellectual ability, or 'g,' predict academic performance (e.g., Jensen, 1973). In spite of the predictive validity of general intellectual ability, a significant proportion of residual variance in academic performance remains unexplained. Researchers in the education (Horn, Bruning, Schraw, & Curry, 1993; Schraw & Dennison, 1994; Schraw & Graham, 1997), learning disability (Van Zile-Tamsen & Livingston, 1999; Vogel, & Adelman, 1990, 1992), and ADHD fields (Nadeau, 1995; Robin, 1998, Teeter, 1998; Turnock, Rosen, & Kaminski, 1998) have emphasized the importance of this residual variance, as general ability reflects a relatively intractable factor by the time students matriculate into postsecondary educational settings.

For well over twenty years, researchers have also investigated the broadband quality of students' academic coping and its effect on learning and academic performance (Schraw, 1998). In contrast to cognitive skills such as those reflected in domain-specific knowledge (e.g., advanced calculus among undergraduates majoring in engineering), academic coping refers to the general strategies and specific behaviors that individuals use to regulate their cognition and learning (Schraw & Graham, 1997). Schraw and

Dennison (1994) explain that academic coping reflects the capacity to "reflect upon, understand, and control one's learning" (p. 460). General academic coping involves the knowledge and regulation of several types of specific academic coping strategies. Therefore, the successful student would be expected to be well versed in and effective in executing strategies related to information management, planning and time management, self-monitoring, problem solving, and self-evaluation. Further, the sub-component and specific academic coping behaviors for each strategy would be appropriately conducted. Schraw (1998) has argued that this multidimensional array of general academic coping strategies (e.g., planning and time management, self-monitoring) and specific coping behaviors (e.g., carrying a calendar or planner, following a pre-determined study schedule) span a variety of academic domains. Thus, the capacity for academic coping enables students to autonomously reflect upon, understand, and control their learning across contexts.

Authors have reported that academic coping predicts significant variation in students' academic performance that is independent of their general intellectual ability (Minnaert & Janssen, 1999; Swanson, 1990) and domain knowledge (Glenberg & Epstein, 1987). This indicates that academic coping represents a distinct explanatory construct in predicting academic performance across development (Schneider & Pressley, 1989). Additional research suggests that the benefits of academic coping are enduring. For example, academic coping has been shown to enhance students' academic performance up through tertiary educational settings (Ruban, McCoach, McGuire, & Reiss, 2003; Vadhan & Stander, 1992; Vogel & Adelman, 1992; Volet, 1991). In a large

sample of undergraduates academic coping independently (i.e., over and above IQ) accounted for half of the variation in academic performance that was explained by undergraduates' general intellectual ability (Minnaert & Janssen, 1999). This finding indicates that academic coping, which can be taught, could serve as a substantial resilience factor for undergraduates with attentional dysfunction or other learning disabilities.

General academic coping strategies and specific academic coping behaviors reflect a crucial set of processes that enable students to more effectively cope in academic contexts and achieve higher levels of academic performance. Research suggests that general academic coping strategies and more specific academic coping behaviors each play an important role in relation to academic performance. At the general level of academic coping strategies, students' knowledge and regulation of different coping strategies are reciprocally inter-correlated such that the higher level of one factor tends to enhance the corresponding level of the other (Pintrich & DeGroot, 1990; Schraw & Dennison, 1994; Schraw & Graham, 1997). For example, Schraw, Horn, Thorndike-Christ, and Brunig (1995) have reported that undergraduates with higher levels of academic coping knowledge use more academic coping strategies and with greater flexibility, thereby obtaining higher levels of academic success. This becomes particularly important as institutions of higher learning demand disproportionately more effective academic coping strategies from their undergraduates (Horn et al., 1993).

Higher levels of academic coping strategy knowledge and regulation have been shown to facilitate learning and academic performance. For instance, more efficient

learners have been shown to evidence declarative knowledge of higher levels of academic coping relative to their less efficient peers (Schneider & Pressley, 1989). Similarly, students with higher levels of procedural understanding for academic coping strategies utilize more heuristics and structured coping approaches; they also appear to implement these skills more effectively and with greater sequential precision than those with less knowledge of how to use academic coping strategies (Pressley, Borkowski, & Schneider, 1987). It has also been reported that the more knowledgeable students are about when to use academic coping strategies the broader their array of academic coping approaches becomes (Glaser & Chi, 1988). Reynolds (1994) has reported that higher levels of conditional knowledge predict students' capacity to allocate their resources selectively and to use their coping skills with greater efficiency. Of critical importance to the fields of learning disabilities and ADHD, higher levels of conditional knowledge may facilitate the behavioral expression of undergraduates' previously latent capacities for academic success. Presumably, this would occur because students would be more apt to effectively utilize the resources they do possess (Schraw, 1998).

The regulation of academic coping has similarly been shown to enhance students' learning and their subsequent academic performance (Brown & Palinscar, 1989; Brown & Pressley, 1994; Cross & Paris, 1988; Sneid & Pressley, 1989). For example, the effective regulation of academic coping has been shown to predict students' enhanced critical thinking (Halpern, 1989), self-efficacy (Schunk, 1989a, 1989b, 1994), overall academic coping (Baker, 1989; Pintrich & DeGroot, 1990; Schraw, 1990; Schraw, Dunkle, Bandixen, & Roedel, 1995; Schraw, Horn, Thorndike-Christ, & Brunig, 1995;

Swanson, 1990; Wolters & Pintrich, 1998), and resulting academic achievement (Schunk, 1990; Schunk & Ertmer, 2000). Regulatory academic coping strategies have also been shown to apply across academic domains up through the undergraduate level (Gourgey, 1998; Schraw, Dunkle, Bandixen, & Roedel, 1995; Schraw, Horn, Thorndike-Christ, & Brunig, 1995; Wolters & Pintrich, 1998). Various investigators have reported on the successful transfer of newly acquired coping approaches to new academic domains (Scruggs, Mastopieri, Jorgensen, & Monson, 1986). The effective regulation of academic coping has also been shown to enhance cognitive engagement, as well as to reduce students' faulty attributional errors (Graham & Weiner, 1996; Schunk, 1989a, 1989b). In spite of such convincing evidence, the effectiveness of academic coping strategies on the remediation of performance deficits has been effectively ignored in the ADHD literature (Robin, 1998; Teeter, 1998).

Academic Coping and its Application: Students with Learning Disabilities, ADHD, and ADHD Symptoms

The construct of academic coping and its predictive association with academic performance has served as the theoretical foundation for large-scale community interventions to enhance self-directed learning among students. Perhaps the most notable are those involving cognitive strategies instruction for students with learning disabilities. With the goal of enhancing the students' academic performance, these interventions have involved teaching academic coping approaches (i.e., strategies and behaviors) to students' with learning disabilities. These types of academic coping-based community interventions have been implemented in various educational settings: large school

districts with children (Harris & Graham, 1996), with adolescents (Butler, Jarvis, et al., 2001; Ellis & Colvert, 1996; Montegue et al., 1997), and with adults with learning disabilities who are attempting to negotiate postsecondary education (Butler, 1993, 1995, 1998c; Butler, Elaschuk, & Poole, 2000). In general, pre-test to post-test evaluations suggest that interventions targeting academic coping enhance the effectiveness of postsecondary students' academic coping strategies, as well as their specific coping behaviors. In their summary of this literature, Wong, Harris, Graham, and Butler (2003) have observed that the students in the aforementioned studies demonstrated improved academic performance at follow-up, with academic coping generalizing across broad contexts as well as specific individual tasks. Authors have suggested that an empirically supported method of this kind may represent a fruitful means of helping learning disabled students to meet the rigorous demands of today's postsecondary educational institutions (Teeter, 1998).

The relevance of this possibility is supported by research conducted by several investigators who have reported on an increased vulnerability of young adults with ADHD as they transition from secondary to postsecondary educational settings (Mannuzza, Klein, Bessler et al., 1993; Seidman, Biederman, Weber, et al., 1998). Deficiencies in academic coping may represent an especially significant risk factor in such reports. In a manner consistent with other learning disabled students, students with ADHD may need to apply a more effective set of academic coping skills in order to demonstrate their knowledge on examinations and meet their scholastic goals. In fact, students with ADHD are reported to exhibit poorer study habits, a failure to consistently

complete their coursework, and a reduced inclination to seek appropriate help from others (Heiligenstein, et al., 1998, 1999; Robin, 1998). Evidently, the enhanced demands of undergraduate institutions often tax the coping capacities of many students with ADHD (Wolf, 2001).

Turnock and colleagues (1998) have also reported that academic coping plays an important part in the relationship between undergraduates' ADHD symptoms and academic performance. Undergraduates they studied with more ADHD symptoms performed at a lower level for current semester GPA and cumulative GPA a semester later. The participants with more ADHD symptoms reported using fewer academic coping strategies and behaviors as measured by the *Coping Strategies Measure* (Turnock, Rosen, & Kaminsi, 1998) and selected scales from the *Survey of Study Habits and Attitudes* (SSHA; Brown & Holtzman, 1965) than their low symptom peers. This indicates that students who are most in need of maximizing their academic coping to compensate for their attentional and hyperactive-impulsive tendencies show significantly lower levels of these adaptive behavior patterns. Turnock and colleagues reported that more than 35% of the variance in differential usage of academic coping was accounted for by undergraduates' level of *DSM-III-R* ADHD symptoms, as measured by the *Adult ADHD Checklist* (Barkley, 1991). These authors reported that students with more ADHD symptoms tend to: (a) approach their studies in a less organized and methodical manner; (b) engage in procrastination more frequently; and (c) implement fewer self-control strategies and self-disciplining coping behaviors. It remains unclear, however, why those most in need of academic coping are the least likely to demonstrate it. As the integrative

model in the present study proposes, deficits in executive functioning may play a key role in this relationship.

It is now recognized that a significant proportion of variation in students' academic performance results from factors that are independent of intellectual ability. While some of these factors are relatively restricted in their application to only one or two academic domains, other variables such as academic coping are potent broadband predictors of academic success. There is extensive empirical support for interventions targeting the academic coping of primary, secondary, and tertiary students with or without learning disabilities. Because several indices suggest that students with ADHD may suffer from broad academic coping deficits, it is argued here that the general coping strategies and specific coping behaviors of undergraduates with ADHD symptoms should be assessed to determine the role that academic coping plays in mediating the relationship between undergraduates' ADHD symptoms and their academic performance.

ADHD SYMPTOMS AND ACADEMIC COPING: THE MEDIATING ROLE OF EXECUTIVE FUNCTIONING

A salient explanation for undergraduates with ADHD symptoms exhibiting reduced academic coping is that having ADHD behavioral symptoms may preclude the development and application of effective problem solving and planning. Following is an introduction and elaboration of the mechanisms responsible for deficiencies in self-regulation. First, this will involve the presentation of a more comprehensive definition of executive functioning. Next, empirical findings linking ADHD behavioral symptoms to

executive functioning will be reviewed. Then, the major facets thought to be responsible for deficiencies in self-regulation will be explored. These facets of executive functioning are the capacity for attentional control and planful problem solving. Supporting evidence will be provided for the use of these observed variables in researching the executive functioning of undergraduates with ADHD behavioral symptoms.

It has been argued that behavioral symptoms of ADHD by their very nature reduce the capacity of individuals with ADHD to carry out what academic coping knowledge they may possess. Other ADHD research indicating that the neurological syndrome results from impaired executive functioning (e.g., Barkley, 1997, 1998; Pennington & Ozonnoff, 1996) provides support for this hypothesis. These authors maintain that individuals with ADHD do not exhibit performance deficits per se, but rather lack the ability to execute consistently their intended behavioral sequences (Barkley, 1997; 1998; Dawson & Guare, 2004). This perspective is primarily based upon recent conceptualizations of ADHD as a disorder of executive functioning.

Several researchers have highlighted the significant effects of executive functioning on the performance of undergraduates with ADHD as well as those with sub-threshold symptom clusters of inattention and hyperactivity-impulsivity (Tannock, Rosen, & Kaminski, 1998; Wasserstein & Lynn, 2001; Wolf, 2001). Because academic coping is viewed as partially dependent upon the effective management of neuropsychological resources across time, space, and context (Beaumeister & Vohs, 2003; McCormick, 2003), students' level of executive functioning could be expected to partially account for their level of academic coping. Further evidence for this notion

comes from Dawson and Guare (2000) who have suggested that executive functioning may affect planful problem solving in novel contexts when more established and automatic strategic behaviors prove insufficient.

ADHD Symptoms and Executive Functioning

Executive functioning is responsible for the coordination and actualization of cognitive processing by way of attentional control and planful problem solving (Nadeau, 1995). Lezak (1995) has offered an explanation of the difference between this cluster of neuropsychological capacities and cognition proper. She has noted that while cognition refers to an individual's accumulated knowledge and the tasks they are functionally capable of performing, executive functioning relates to how and whether a person can reliably performs certain tasks. This distinction may be simplified with an illustration. An undergraduate with ADHD symptoms may have a perfectly intact intellectual quotient for academic success, without being able to select effectively and execute a complex, multi-step plan, manage time during the execution of the plan, or self-regulate and self-correct as pro- and anti-plan consequences are encountered (Barrett & Gonzales-Rothi, 2002; Nadeau, 1995). Thus, according to these authors (Barkley, 1998; Nadeau, 1995; Robin, 1998; Teeter, 1998), students with ADHD suffer from critical deficits in the neuropsychological processes that effectively govern goal-directed behavior within their academic environment. These "executive" skills are not only essential to college success, but are also frequently missing in students with ADHD symptoms enrolled on university campuses (Wolf, 2001).

These authors place primary emphasis on the role of assessment and evaluation in determining which types of executive functioning warrant intervention for a given student. As Barkley (1998) and Nadeau (1995) stress, such an evaluation could facilitate the development of interventions individually tailored to each student's specific neuropsychologically based deficiencies in executive functioning. A neuropsychologically based and functionally derived synthesis of this sort may enable undergraduates with ADHD symptoms to achieve more effectively their abstract and concrete academic goals (Wasserstein & Lynn, 2001).

Major Facets of Executive Functioning

Despite overwhelming agreement that reduced executive functioning places students with ADHD symptoms at risk for reduced academic success, this has not been explored in the adult ADHD literature (Tannock, Rosen, & Kaminski, 1998). This is partly because the exact mechanisms responsible for executive functioning remain unclear (Cicerone, 2002). For example, the role executive functioning plays in students' academic behavior could be construed at two distinctive levels of analysis. On the one hand, undergraduates' attentional control – working memory and processing speed – is a critical manifestation of executive functioning that is responsible for efficient self-regulation (Beaumeister & Vohs, 2003; Mirsky & Duncan, 2001). Impairments in this process clearly interfere with the sequential enactment of complex, multi-step plans (Dawson & Guare, 2004; Nadeau, 1995). On the other hand, executive functioning in academic contexts also involves the processes associated with planful problem solving. This latter construct enables students to more effectively set goals, reason logically,

determine cause-effect relationships, and efficiently regulate their academic behavior in a more planful manner. Authors have stressed that planful problem solving is especially important in novel contexts (Wasserstin & Lynn, 2001; Wolf, 2001).

Investigators using factor analytic statistical procedures suggest that executive functioning tends to cluster on two underlying processes in patients with ADHD. Wozniak and Greeish (1998) have reported that the orbitofrontal-inhibitory factor is primarily responsible for attentional control, whereas the dorsolateral-executive factor subserves the capacity for planful problem-solving. This dichotomous framework has also received considerable empirical support in recent functional neuroimaging studies (Geschwind & Iacoboni, 1999) and in developmental studies of children with ADHD (Geidd et al., 2001). These findings provide support for this neuropsychological model of the complex array of neurocognitive operations, whose proper execution results in efficient self-regulation and goal attainment.

In recent years, this general theoretical model of executive functioning and ADHD academic deficits has received considerable empirical support. The developmental span of individuals with ADHD is associated with a host of impaired neuropsychological processes (Seidman, Biederman, Caraone, et al., 1997; Seidman, Biederman, Weber, et al., 1998; Woods, Lovejoy, & Stutts, 2002), which some authors have argued are less pervasive in adulthood (Spencer et al., 2000). Nonetheless, most researchers support Barkley (1997) and maintain that individuals with ADHD suffer from deficits related to at least these two neuropsychological domains, namely, attentional control and planful problem solving (Sergeant, Geurts, & Oosterlaan, 2002; Weiss,

Hechtman, & Weiss, 1999). Unfortunately, neither of these indices of executive functioning has been systematically investigated among undergraduates with ADHD symptoms in relation to their academic coping. Consequently, the role that deficits in such functions play in predicting the academic coping of undergraduates remains to be determined.

Executive Functioning Deficiencies in Attentional Control. Evidence across disciplines supports the importance of attentional control in virtually every complex cognitive process (Beaumeister & Vohs, 2003). Some authors have argued that the importance of attentional control cannot be overemphasized in the evaluation of goal-directed persistence as this capacity requires the online maintenance of necessary information, simultaneous suppression of irrelevant material, and processing of novel incoming information (Bunge, et al., 2001). Several authors have also stressed the impact of deficiencies in attentional control for those with ADHD (Denckla, 1996; Mirsky & Duncan, 2001). Furthermore, prospective-longitudinal follow up studies of children with ADHD report unremitting deficiencies in this area of executive functioning among adults who retain the disorder (Jenkins, et al., 1998; Seidman, et al., 1998). Neurophysiological research has effectively established that significant overlap exists among the brain regions responsible for attentional control over time (Bunge, et al., 2001; Casey, Tottenham, & Fosella, 2002; Miller & Cohen, 2001), especially as task demands increase and more effortful processing is required (Carte, Nigg, & Hinshaw, 1996).

Several investigations have further documented developmental continuity of orbitofrontal-inhibitory deficits in children, adolescents and adults with ADHD.

Attentional control in children with ADHD, as assessed with behavioral inhibition paradigms, is reportedly less efficient (Mariani & Barkley, 1997; Sonuga-Barke, Dalen, Daley, & Reington, 2002). Similar deficits exist for adolescents (Fischer et al., 1993; Seidman et al., 1997) and adults with the disorder (Jenkins, Cohen, Malloy, et al., 1998; Seidman et al., 1998). Dysregulated inhibitory processes across cortical regions also occur in youths with ADHD (Moll, Heinrich, Trott, et al., 2000). Among children (Clark, Prior, & Kinsella, 2002), adolescents (Fischer et al., 1993; Seidman et al., 1997), and adults with the disorder (Katz, Wood, & Goldstein, 1998; Johnson, Epstein, Waid, et al., 2001), motor and verbal fluency are also reduced as a consequence of impaired attentional control. Together, these output deficits leave individuals with ADHD at risk with less consistent self-regulation as they attempt to meet developmentally appropriate goals.

Executive Functioning Deficiencies in Planful Problem-Solving. This second cluster of executive functioning involving planful problem solving may be construed as multiple-component and higher-order processes (Nadeau, 1995). These more sophisticated and complex operations are largely dependent upon the ability to control attentional resources efficiently (Barkley, 1998; Johannsen, Aase, Meyer, et al., 2002). Recent developmental and neurophysiological research among persons with ADHD shows that various forms of higher order processes are disrupted without appropriate attentional control (Nigg, Butler, Huang-Pollack, & Henderson, 2002; Ross, Hommer, Breiger, et al., 1994). Indeed, other investigators have reported that individuals with

ADHD show similar patterns of executive functioning deficiencies across development (Murphy et al., 2001; Seidman et al., 1997, 1998).

Individuals with ADHD are less able to process information online and are less effective at changing set (i.e., shifting from one approach or tact to another) (Douglas, Barr, Desilets, & Sherman, 1995; Johnson et al., 2001). Neurophysiological investigations demonstrate the latter capacity is contingent upon attentional control (Konishi, Kawazu, Uchida, et al., 1999; Nathaniel-James, Fetcher, & Frith, 1997). This feature of planful problem solving, often called mental flexibility, is a critical aspect of efficient self-regulation (Beaumeister & Vohs, 2003; Carver & Sheier, 2000). The complex sequence of operations required for effective planning and follow through is impaired in this population, thereby undermining academic performance (Johnson et al., 2001; Katz et al., 1998). The list of executive functioning deficiencies related to planful problem solving that affect adults with ADHD includes difficulties with planning (Murphy, 1999), complex problem solving per se (Lazar & Frank, 1997; Seidman et al., 1997) and associated sub-functions (Barkley, 1997; Barkley, Edwards, Laneri, et al., 2001; Klorman, Bruaghim, Fitzatrick, et al., 1992; Mirsky & Duncan, 2001), as well as deficiencies with prospective memory, or whether a person remembers to carry out a task (Barkley, 1998; Nadeau, 1995; Weiss, Hechtman, & Weiss, 1999). To date the role of executive functioning, at the level of attentional control and planful problem solving, in undermining the use of academic coping behaviors has not been explored in undergraduates with ADHD (Robin, 1998; Teeter, 1998; Turnock, Rosen, & Kaminski, 1998) and warrants further investigation.

This section addresses a salient explanation for reduced academic coping in undergraduates with ADHD symptoms. It is argued on the basis of the neuropsychological findings in the ADHD literature that reduced executive functioning associated with ADHD symptomatology is likely to undermine undergraduates' capacity to effectively develop, self-regulate, and carry out the coping strategies and behaviors that they are familiar with. The conceptualization of ADHD as a disorder of executive functioning is consistent with this hypothesis. Further, two critical facets of executive functioning and resultant self-regulation, attentional control and planful problem solving, were postulated to partially mediate the association between undergraduates' ADHD symptoms and their level of academic coping. In the next chapter, an integrative model is introduced that incorporates such an understanding. This model proposes that the association between ADHD symptoms and poor postsecondary academic performance is mediated by two variables: reduced executive functioning and deficiencies in academic coping.

CHAPTER 3: AN INTEGRATIVE MODEL

In the present investigation an integrative model of ADHD functioning in an undergraduate academic context will be evaluated through structural equation modeling (SEM) methodology. A brief summary of the model will be presented here in terms of the study's hypotheses, before more explicitly detailing the model. According to the model (see Figure 1), a higher level of ADHD symptoms will predict reduced academic performance. In addition, the model proposes that the poorer academic coping of these students (indexed by both strategies and behaviors) partially mediates this relationship. Further, deficiencies in executive functioning (indexed by both attentional control and planful problem solving) partially explain the lower level of academic coping in students with ADHD symptoms. Finally, the model proposes that undergraduates' level of executive functioning and academic coping more fully explain the association between their ADHD symptoms and level of academic performance.

The present investigation will involve recruiting undergraduates from the Greater Austin Area for participation in this study. Eight observed variables, two for the latent predictor variable, two for the latent criterion variable, and two for each of the two mediating variables will index the assessment of these latent constructs. Attention-Deficit/Hyperactivity Disorder (ADHD) symptoms will be indexed by evaluating participants' self-reported childhood and current ADHD symptoms at the beginning of their first or second year in college. Data will be collected with two empirically supported behavioral measures of adult ADHD (*Childhood Symptom Scale* and *Current Symptom Scale*, Barkley & Murphy, 1998). Recording undergraduates' latent criterion variable of

academic performance will be assessed with the observed variables of undergraduates' semester GPA and problematic courses. Semester GPA will be collected at the end of the semester in which the undergraduate participates in the study as well as after the following term. Problematic courses will comprise the sum of participants' failing grades, incomplete courses, and withdrawn courses at the end of each semester. The model proposes that the latent predictor variable of ADHD symptoms will negatively predict the latent criterion variable of academic performance, replicating earlier research demonstrating that students with ADHD symptoms evidence reduced academic performance (e.g., Heilegenstein, et al., 1998, 1999; Turnock, Rosen, & Kaminski, 1998).

In the mediating paths of the model, executive functioning is predicted to partially mediate the association between undergraduates' ADHD symptoms and their level of academic coping. The measurement of the latent mediating variable of executive functioning will involve evaluation of two observed variables: attentional control and planful problem solving. Two well established neuropsychological measures that are known to tap orbitofrontal and dorsolateral regions of the prefrontal cortex will be used. Importantly, each of these regions has been shown to respectively subserve the general capacity of attentional control and the ability to problem-solve planfully (Markowitsch, 2000; Nyberg & Cabeza, 2000).

Further, in the model the latent construct of academic coping will be evaluated for the mediational role it serves in the predictive association between ADHD symptoms and academic performance. Undergraduate participants' level of academic coping, as a latent construct, is expected to partially account for the reduced academic performance in

students with more ADHD symptoms. Measurement of the latent construct of academic coping will be conducted using two observed variables. Participants will complete two self-report questionnaires tapping empirically supported general academic coping strategies and specific academic coping behaviors (Wong, Harris, Graham, & Butler, 2003; Zigmond, 2003). The first observed variable is a measure of undergraduates' knowledge and use of general academic coping strategies in academic contexts. The second observed variable taps undergraduates' use of specific academic coping behaviors and skills that have been shown to facilitate the remediation of deficiencies in executive functioning and enhanced academic performance (Nadeau, 1995; Robbin, 1998; Semrud-Clikeman, 2003; Waugh, 2002a). These coping measures are particularly appropriate for use at the university level (Wasserstein & Lynn, 2001; Wolf, 2001).

Finally, in a test of the full model, the extent to which ADHD symptoms predict academic performance will be evaluated after accounting for the mediational roles of executive functioning and academic coping. It is expected that the inverse relationship between ADHD symptom status and academic performance will be more fully accounted for by the level of undergraduates' executive functioning and academic coping. In these ways a latent variable model of ADHD functioning in an undergraduate academic context will be explored; with executive functioning partially accounting for the level of students' academic coping, undergraduates' academic coping partially explaining the negative association between ADHD symptom status and academic performance, and executive functioning and academic coping more fully explaining the inverse relationship between undergraduates' ADHD symptom status and academic performance.

SUMMARY

There is increasing recognition that investigating the academic risk of students with ADHD warrants a dimensional approach to understanding the disorder. Several studies suggest that students with ADHD symptoms suffer from significant academic risk. In addition, there is a need for a broader understanding of the relationship between ADHD symptoms and academic performance, particularly for college undergraduates. Because of limited empirical information available to date (Robin, 1998; Teeter, 1998; Turnock, Rosen, & Kaminski, 1998), the proposed study is designed to document the nature and mechanisms underlying the reduced academic performance of undergraduates with variable levels of ADHD symptoms. An integrative model has been presented to provide a broader understanding of the mechanisms responsible for the relationship between ADHD symptoms and reduced undergraduate academic performance. This model makes four predictions. First, a higher level of ADHD symptoms will predict reduced academic performance. In addition, the model proposes that the academic coping of these students, as indexed by both strategies and behaviors, partially mediates this relationship. Further, executive functioning, as indexed by both attentional control and planful problem solving, partially explains the level of academic coping in students with ADHD symptoms. Finally, the model proposes that undergraduates' level of executive functioning and academic coping will more fully explain the association between their ADHD symptoms and their level of academic performance.

HYPOTHESES

ADHD Symptoms and Academic Performance

Hypothesis 1. On the basis of abundant data suggesting that students with ADHD perform below expected levels relative to their peers (e.g., Biederman et al., 1993, 1994; Mannuzza et al., 1991, 1997) and that non-clinical undergraduates with high levels of ADHD symptoms are also at increased risk for academic failure (Turnock, Rosen, & Kaminski, 1998), it is predicted that ADHD symptoms will negatively predict academic performance.

ADHD Symptoms and Academic Performance: The Mediating Role of Academic Coping

Hypothesis 2a. Recent empirical investigations (Swanson, Harris, & Graham, 2003) as well as comprehensive meta-analyses (Swanson, Hoskyn, & Lee, 1999) suggest that several general academic coping strategies and specific academic coping behaviors facilitate student performance on a host of achievement-related dimensions among Normative students. It is therefore predicted academic coping will positively predict academic performance.

Hypothesis 2b. Despite the lack of controlled research specifically investigating academic coping behaviors among undergraduates with ADHD (Handen, McAuliffe, & Caro-Martinez, 1996; Robin, 1998; Teeter, 1999), several reports of mixed samples of undergraduates with Learning Disorders and/or ADHD indicate that students with ADHD do not use effective coping behaviors (Wolf, 2001; Wong, Harris, Graham, & Butler, 2003). A number of studies from the ADHD literature also suggest that these individuals

typically lack the requisite academic coping behaviors necessary for success in a postsecondary academic setting (Mannuzza, Klein, Bessler, et al., 1993; Teeter, 1999; Wolf, 2001). Several authors have concluded that students with ADHD exhibit deficiencies in their overall level of academic coping (Nadeau, 1995; Robin, 1998; Teeter, 1999; Wasserstein & Lynn, 2001; Wolf, 2001). This has been demonstrated empirically in undergraduates with higher levels of ADHD symptoms (Rosen, Tannock, & Kaminski, 1998). Therefore, it is predicted that ADHD symptoms will inversely predict academic coping.

Hypothesis 2c. On the basis of the findings just cited, the empirical literature associates academic coping with academic performance among Normative Controls as well as learning disabled students. Similarly, the literature suggests that there is good reason to purport that ADHD symptoms are associated with deficiencies in academic coping. Further, there is reason to suspect that academic coping may mediate the predictive relationship between ADHD symptoms and undergraduate academic performance. It is therefore predicted that the inverse predictive relationship between ADHD symptoms and academic performance will be partially explained by academic coping after controlling for the number of students' registered hours, ongoing behavioral interventions from the respective Services for Students with Disabilities, and use of psychostimulant medication for undergraduates diagnosed with ADHD.

ADHD Symptoms and Academic Coping: The Mediating Role of Executive Functioning

Hypothesis 3a. An abundant literature suggests that individuals with ADHD frequently suffer from a complex array of executive functioning deficiencies. It is therefore predicted that ADHD behavioral symptoms will inversely predict executive functioning.

Hypothesis 3b. Numerous authors in the ADHD literature have emphasized that individuals with ADHD do not lack the requisite knowledge or skills for goal attainment and academic success (Barkley, 1994, 1998, 1999; Dawson & Guare, 2004). Rather, these authors have argued that individuals with ADHD lack the necessary neuropsychological substrates responsible for the executive functioning that permits efficient and consistent self-regulation. Furthermore, authors have proposed that deficiencies in executive functioning by their very nature may compromise the acquisition of new knowledge and understanding of academic coping strategies and behaviors (Tannock, Rosen, & Kaminski, 1998). It follows that deficiencies in executive functioning could hinder the regulation of students' academic coping. On the basis of these arguments it is therefore predicted that executive functioning will positively predict academic coping.

Hypothesis 3c. There is considerable agreement among researchers that problematic executive functioning is directly responsible for the reduced capacity for self-regulation exhibited by individuals with ADHD (Barkley, 1997, 1998; Dawson & Guare, 2004; Nadeau, 1995). These and other authors have posited that deficiencies in

executive functioning will reduce the self-regulation of students with ADHD, thereby diminishing what academic coping resources they may already possess. As self-regulation is ultimately responsible for goal-directed persistence, this may be a significant factor in determining the level of undergraduates' academic coping. It is predicted that executive functioning will partially explain the inverse predictive relationship between undergraduates' ADHD symptoms and academic coping.

An Integrative Model of ADHD Symptoms and Academic Performance

Hypothesis 4. An integrative model will be tested that builds upon this series of relationships. This model proposes that executive functioning and academic coping together more fully mediate the negative predictive relationship between undergraduates' ADHD symptoms and academic performance.

CHAPTER 4: METHOD

PARTICIPANTS

One hundred and eleven broadly representative first- and second-year male and female undergraduates from The University of Texas participated in this study. At entry participants were between the ages of 18- and 20-years. The sample was recruited from the Dean of Students Office (i.e., Service for Students with Disabilities) and Introductory Psychology 301 Courses at The University of Texas. Additional participants were recruited from a more general student population to reach the total sample population. A two-phase recruitment approach was intended to provide a full range of participants' ADHD behavioral symptoms along the spectrum from normality to clinically significant levels of impairment. Participants recruited from The Dean of Students Office at The University of Texas responded to email solicitation and posted fliers. Participants from the Psychology 301 pool received course credit for participation, whereas participants recruited through other means were be compensated $30 for their participation in this study. The first phase of recruitment targeted students with a higher likelihood of having both symptom-clusters of ADHD symptoms. Childhood ADHD symptoms will help to differentiate participants with a diagnosis of ADHD primarily inattentive subtype (IA), hyperactive-impulsive type (HI), or combined type (CT). No a priori hypotheses for these subtypes will be made. Efforts to obtain 32 students with ADHD (16 IA and 16 HI/CT) were unsuccessful. Of the 111 undergraduates participating in the study, only 18 received a prior diagnosis of ADHD. Participants reporting six of nine clinically significant elevations within a symptom cluster were grouped, initially, according to subtype

distribution (see Results). Of the total sample ($N = 111$), the childhood rating Normative Control group ($N = 84$) was larger than the ADHD group ($N = 21$). Adult ratings of ADHD yielded groupings of similar magnitude for Normative Control ($N = 83$) and ADHD ($N = 18$), respectively.

When self-reported symptoms were tabulated only 21 participants met diagnostic criteria for ADHD in childhood, while 18 met diagnostic criteria for ADHD in adulthood. Each of the 18 adult ADHD grouped participants reported a childhood onset of their symptoms. All members of ADHD syndrome groups reported clinically significant impairment due to their symptoms. The childhood ADHD syndrome analyses were based upon a sample of 105 participants. The adult ADHD syndrome analyses were based upon a sample of 101 participants.

SAMPLE SIZE

Several sources of information suggest that a sample size of 100 is sufficient to provide adequate power, according to Cohen's (1992, 1998) formulations, to test the proposed model. Two indices are particularly relevant to the adequacy of such a sample size. First, the effect sizes of the neuropsychological instruments for use in this study are well documented and reflect pronounced sensitivity to symptoms of ADHD (Aman, Roberts, & Pennington, 1998; Jenkins, Cohen, Malloy et al., 1998; Katz, Wood, & Goldstein, 1998; MacLeod & Prior, 1996; Murphy, 1999; Pennington, Groisser, & Welsh, 1993; Sweitzer, Faber, Grafton, et al., 2000). Supporting evidence is provided in the respective descriptions of the measures outlined below. The adequacy of a sample

size of 100 participants is also indicated when the academic coping behavior of Normative students is taken into account. Prior research suggests that large effect sizes are associated with the academic coping of students with variable levels of ADHD symptoms (e.g., Glutting, Monaghan, Adams, & Sheslow, 2002; Turnock, Kaminski, & Rosen, 1998).

MEASURES

In order to examine the association between the latent variables of participants' academic performance and ADHD symptoms, first and second year college students were recruited for participation in this study. The assessment of these latent constructs was indexed by eight observed variables: two for the latent predictor variable, two for the latent criterion variable, and two each for the mediating variables. Attention-Deficit/Hyperactivity Disorder (ADHD) symptoms were assessed using participants' self-reported childhood and current ADHD symptoms at the time of participation. Data was collected with the *Childhood Symptom Scale* and *Current Symptom Scales* (Barkley & Murphy, 1998) two empirically supported behavioral measures of adult ADHD. Recording undergraduates' latent criterion variable of academic performance was assessed with the concurrent and cumulative observed variables of undergraduates' GPA, problematic courses, and hours completed. Each participant's academic outcome indices were collected at the end of each semester. Problematic credit hours comprised the sum of participants' failing grades, incomplete courses, and withdrawn courses at the end of each semester. Completed credit hours constituted the number of course credit hours the

participants finished either concurrently at study entry, or cumulatively 24-months thereafter. The model proposes that the latent predictor variable of ADHD symptoms will predict negatively the latent criterion variable of academic outcome, replicating earlier research demonstrating that students with ADHD symptoms evidence reduced academic performance (e.g., Heilegenstein, et al., 1998, 1999; Turnock, Rosen, & Kaminski, 1998).

The proposed investigation also evaluated participants' executive functioning, academic coping, and general scholastic aptitude (see Table 2). An attempt was made to measure two key aspects of executive functioning known to afflict individuals with ADHD. This involved first evaluating undergraduates' attentional control with the *Paced Auditory Serial Addition Task* (PASAT; Gronwall & Sampson, 1974). Then, executive functioning concerning planful problem solving was evaluated with an instrument identified in the literature as the *Tower of Hanoi* (TOH; Welsh, Pennington, & Groisser, 1991). The specific version administered is called the *Delis-Kaplan Executive Function System (D-KEFS) Tower Task* (Delis, Kaplan, & Kramer, 2001). Further, the theoretically derived *Survey of Academic Coping Strategies-General* (SACS-General) and *Survey of Academic Coping Strategies-Specific* (SACS-Specific) assessed participants' self-reported use of general academic coping strategies and specific academic coping behaviors, respectively. General scholastic aptitude was indexed by the *Scholastic Assessment Test* (SAT; College Board, 1995) and the *American College Test* (ACT; American College Testing Program, 1994). These indices were recorded to rule-out potential interpretive confounds in group comparisons. Due to a lack of group differences on these variables, statistical control was not indicated. Students were asked if they were

administered either of these tests with accommodations for a learning disability (e.g., extended examination time). None endorsed requesting or receiving such accommodations on these tests. Finally, measures concerning neurological history (*Health History Questionnaire*; Barkley & Murphy, 1998), presence and level of psychiatric co-morbidity for mood (*Mood Assessment Scale*; MAS; Yesavage, Brink, Rose, Lum, et al., 1983) and anxiety disturbance (*Beck Anxiety Inventory*; BAI; Beck & Steer, 1990) were used to establish eligibility criteria. The latter indices in emotion regulation were also used in subsequent exploratory analyses.

Executive Functioning

Attentional Control. The *Paced Auditory Serial Addition Task* (PASAT; Gronwall & Sampson, 1974) was administered as a neuropsychological instrument uniquely designed to evaluate participants' attentional control. This measure is a very challenging and effective measure of attentional control during online processing (Gronwall, 1977; Gronwall & Sampson, 1974; Lezak, 1995; Spreen & Strauss, 1998). This instrument has also been used relatively frequently in recent studies of adult ADHD (Katz, Wood, & Goldstein, 1998; Jenkins et al., 1998; Seidman et al., 1996; Sweitzer, Faber, Grafton, et al., 2000). The PASAT yields large effect sizes when administered to adults with ADHD, showing high levels of sensitivity for detecting ADHD in adulthood (Katz, Wood, & Goldstein, 1998). In their respective adult ADHD samples, Jenkins, Cohen, Malloy et al. (1998) and Sweitzer, Faber, Grafton, et al., (2000) reported large effect sizes for the PASAT (∂ = .74 - .92). The equivalent effect sizes and reduced

performance of adolescents with ADHD on the PASAT provide converging evidence for the validity of this measure's assessment of attentional control (MacLeod & Prior, 1996).

Administration of the PASAT involves a pre-recorded tape that delivers a random series of 61 numbers from 1 to 9. The subject is instructed to add pairs of numbers such that each number is added to the one that immediately precedes it: the second is added to the first, the third to the second, the fourth to the third, and so on. For example, after the numbers "1, 9" the answer is "10"; if the next number is "4", this is added to the previous "9" to give the answer "13"; and so on. Thus, the subject is required to listen to the auditory input, respond verbally, and process the next stimulus in a series at an externally determined pace. The same 61 numbers (duration of each spoken digit is about .4-seconds), given in the same sequence, are presented in four different trials, each trial differing in its inter-stimulus interval (2.4, 2.0, 1.6, 1.2-seconds). The PASAT thus increases processing demands for attentional control by increasing the speed of stimulus presentations.

The PASAT shows high internal consistency (Egan, 1988), with a Cronbach $\alpha = .90$ (Crawford, Obansawin, & Allan, 1999). Performance across the different trials is highly correlated ($r = .76$ - $.95$) (MacLeod & Prior, 1996). Similarly, test-retest reliability for 7-10 days is high ($r \geq .90$; McCaffrey, Cousins, Westervelt, et al., 1995). Construct validity as well as convergent validity are supported by the PASAT's loading on the Freedom From Distractibility factor of the *Wechsler Adult Intelligence Scale – Revised Edition* (WAIS-R; Deary, Langan, Hepburn, & Frier, 1991) in addition to other measures of attention and memory among head-injured patients (e.g., Gronwall & Wrightson,

1981). Roman, Edwall, Buchanan, and Patton (1991) have also extended the norms of the PASAT. Gronwall and colleagues (1974; 1981) have provided support for the discriminant validity of the PASAT, as indicated by the low correlations with measures of arithmetic ability (r = .28) and general intelligence (r = .28) among neurological patients.

Planful Problem Solving. In addition to the PASAT, the *Tower of Hanoi* (TOH) was used to assess undergraduates' level of planful problem solving. As indicated, the specific version administered is called the *Delis-Kaplan Executive Function System (D-KEFS) Tower Task* (Delis, Kaplan, & Kramer, 2001). The TOH requires the participant to use planning and execution of a problem solving strategy in accordance with a set of rules to achieve an externally determined goal (Simon, 1975). The participant must therefore anticipate the long-range consequences of the individual's actions. Additionally, the TOH taps the ability to keep a complex set of rules in working memory and to use these rules to guide behavior.

The materials for the TOH consist of two identical boards (one for the participant and the other for the experimenter), each holding three tapered vertical pegs arrayed in a straight line and four plastic rings of graduated sizes that fit on the pegs. There are three rules: (a) a larger ring may not be placed on top of a smaller ring; (b) only one ring may be moved at a time; and (c) a ring has to be moved to one of the participant's pegs. The experimenter's board displays the externally determined goal state, a four- or five-ring pyramidal configuration.

The initial set up of the rings on the participant's board (the initial state for each trial) differs for each problem. The number of moves associated with each optimal solution (fewest moves to achieve the desired goal state) reflects each problem's difficulty in planful problem solving. Problems requiring fewer moves to goal state are considered easier than problems requiring more moves. A solution is correct if the goal state is replicated in the fewest number of moves. To pass a problem, the participant must correctly solve the problem on two consecutive trials out of a maximum of six trials. Once the participant passes a problem, the next more challenging problem is administered to the participant. The TOH is terminated when a participant fails two consecutive problems. Points are assigned per problem on the basis of the number of trials the participant needed to pass it as described by Borys, Spitz, and Dorans (1982). Failed problems receive a score of zero. Summing the points across the individual problems yields a total score.

This task demonstrates significant effect sizes when administered to participants with ADHD through development. Pennington, Groisser, & Welsh (1993) have reported a significant difference in the performance (number of moves) of children with *DSM-III-R* ADD ($\partial = 1.17$). These authors pointed to impulsive responding as the primary interfering component of the ADD youth's imprecision. Klorman, Hazel-Fernandez, Shaywitz, et al. (1999) reported similarly impressive findings. Among a combined sample of 359 children with ADHD (CT and IA), reading disorder (RD), oppositional-defiant disorder (ODD), and 28 normative nontrols, these authors reported that the combined type (CT) evidenced solving fewer puzzles and violating more rules

than the ADHD/IA or participants without ADHD. Aman, Roberts, and Pennington (1998) reported a smaller effect size (∂ = 1.0) for total accuracy score in a sample of children and adolescents with ADHD relative to normative controls. Among adults with ADHD, Murphy (1999) reported somewhat lower effect sizes across several of the instrument's dependent variables. She reported the following effect sizes for adults with ADHD relative to normative controls: (a) time to first move (∂ = .39); (b) number of moves (∂ = 1.09); (c) number of errors (∂ = .55); and (d) time to solution (∂ = .68).

The TOH has been recommended for the assessment of planful problem solving in the neuropsychological literature (Delis, Kramer, & Kaplan, 2004), and demonstrates adequate psychometrics as a neuropsychological instrument. Welsh and Huizinga (2001) reported sufficient internal consistency (Cronbach α = .77) for selected items from the TOH. Gnys and Willis (1991) reported adequate test-retest reliability (r = .72). In a community sample of 2,798 normative adults aged between 35- and 85-years-old, Ronnlund, Lovden, and Nilsson (2001) reported sufficient long-term reliabilty for a five-year test-retest reliability interval (e.g., r = .45 for TOH move latency among participants aged 40- and 45-years). Convergent validity for the instrument's assessment of problem solving, as indexed by number of moves to solution, is also suggested by the task's correlation (r = .77) with participants' performance on the Raven's Progressive Matrices, a measure of fluid reasoning (Carpenter, Just, & Shell, 1990). Authors have also reported concurrent validity with the Tower of London, which is also purported to measure planful problem solving (Lehto, 1996; Welsh & Huizinga, 2001). Criterion validity is not only suggested by the group differences among patients with ADHD just described, but

similar findings have been reported among samples of child (Levinson, Mendelson, Lilly, et al., 1994) and adult (Shallice, 1982) neurological patients with frontal lobe damage. Discriminant validity for the TOH is suggested by only moderate correlations with IQ (Ewert & Lambert, 1982; Vernon & Strudensky, 1988).

Academic Coping

Undergraduate students' academic coping was assessed with two measures designed to respectively evaluate the general academic coping strategies and specific academic coping behaviors often associated with students' approaches to studying, learning, and achieving in an academic context (Waugh, 1998, 2002a, 2002b). Items for both instruments were taken from earlier surveys (e.g., Antonietti, Ignazi, & Perego, 2000; Musch & Broder, 1999; Schraw & Dennison, 1994; Waugh, 2002a, 2002b; Weinstein, Schulte, & Palmer, 1987) and reports (Nadeau, 1995; Robin, 1996; Teeter, 1998) and have been adapted to the research questions of the present investigation. Specific items known to affect academic performance (Baher & Brown, 1984; Brown & Palinscar, 1989; Brown & Pressley, 1994; Cross & Paris, 1988; Howard & Tobias, 1998; Stankov, 2000) and thought to more effectively distinguish the academic coping of students whose ADHD symptoms fall at the higher versus lower ends of the continuum were given priority during the development of the scales.

The conceptual and structural core of these academic coping assessment instruments is based upon the multi-dimensional construct of academic coping discussed earlier. The measures are broadly organized along Corno and Kanfer's (1993) summary of volitional control strategies associated with academic coping. Therefore, general

academic coping strategies are grouped according to emotional- and motivational-, environmental-, and metacognitive-control strategies. Metacognitive control strategies on these measures are also differentiated according to the conceptual and empirical work of investigators discussed earlier (e.g., Schraw & Dennison, 1994).

General Academic Coping Strategies. The *Survey of Academic Coping Strategies – General* (SACS-General) is a 35-item behavioral self-report questionnaire developed to assess participants' use of general academic coping strategies. The instrument assesses the broad domains of Corno and Kanfer's (1993) model of volitional control strategies by measuring students' use of Emotional and Motivational Control Strategies, Environmental Control Strategies, and Metacognitive Control Strategies in accordance with the differentiated sub-factors of Knowledge and Regulation of Academic Coping. These sub-factors are further divided into their constituent general academic coping strategies. The Knowledge of Academic Coping sub-factor includes strategies related to Scientific Reasoning, Structured Learning with Memory Techniques, and Organized Study and Learning. Corresponding strategies comprise the Regulation of Academic Coping sub-factor. Strategies in this portion of the SACS-General relate to students' Planning and Executing Academic Coping, Self-Monitoring of Academic Engagement and Comprehension, and Self-Evaluation and Correction. Each item on the survey is rated on a point scale corresponding to the number of courses towhich a coping strategy is regularly implemented. Individual item ratings typically range from 0 (*In none of my courses*), to 5 (*In five of my courses*). Participants' total scores on the SACS-General

range according to the number of courses for which the participant is enrolled. Higher scores on the instrument reflect enhanced use of general academic coping strategies.

The SACS-General also contains strategy-clusters within each of its major Emotional and Motivational-, Environmental-, and Metacognitive Control Strategies. For example, Emotional and Motivational Control Strategies are broken into two separate groups of sub-strategies. The first group of items concerns Emotional-Control Strategies (4-items) related to academic coping. This portion includes items related to: (a) seeking out helpful information from knowledgeable others; (b) seeking out emotionally supportive others; (c) reappraising disappointing circumstances; and (d) using strategic reasoning and problem solving to address distressing concerns. The second group of items concerns Motivational-Control Strategies (2-items) relevant to an academic setting. This portion of the survey assesses students' use of academic coping and motivational-control sub-strategies involving: providing oneself with positive reinforcement and implementing personally effective self-regulatory strategies to remain on-task.

The second section of the SACS-General relates to Environmental Control Strategies (2-items) involved with academic coping. In this section, students' use of strategies that control their study environment is assessed. Specifically, students' rate their use of Environmental Control Strategies including: reducing enticing distractions while studying as well as reducing the number of competing activities present when studying and learning.

The third section of the SACS-General assesses Metacognitive Control Strategies' used by undergraduates (27-items). This portion of the instrument is broken into the

constituent parts related to Knowledge of Academic Coping (16-items) and Regulation of Academic Coping (11-items). The former first assesses the strategy-cluster of Scientific Reasoning (4-items), which involves items tapping: (a) contrasting viewpoints; (b) examining the evidence and logic of arguments; and (c) thinking critically and evaluating course material. Similarly, the strategy-cluster of Structured Learning with Memory Techniques (7-items) may be broken down into constituent components of: (a) making information more meaningful during encoding; (b) relating and meaningfully organizing course material; and (c) summarizing course material in the student's own words. Examples of items tapping the Organized Study and Learning strategy-cluster (4-items) include: (a) surveying course materials to more efficiently plan and utilize study time; (b) discriminating between the most and least important course material; and (c) organizing test preparation and self-testing according to the format of the course examination.

The three strategy-clusters comprising the Regulation of Academic Coping may also be broken down into their constituent sub-strategies. For instance, Planning and Executing Academic Coping (4-items) incorporates students:' (a) generating academic goals; (b) devising plans to reach those goals; and (c) considering, in advance, obstacles to reaching academic goals. The Self-Monitoring of Academic Engagement and Comprehension (3-items) involves: (a) considering study and learning like an objective observer; (b) doing work sequentially rather than multi-tasking; or (c) making good use of spare time for learning and studying. Finally, students' Self-Evaluation and Correction (4-items) involves: (a) periodically determining whether or not academic goals are being met; (b) changing approaches when new information indicated that a previous plan

required modification; and (c) re-evaluating assumptions when encountering a scholastic problem or having confusion about course material.

Specific Academic Coping Behaviors. The *Survey of Academic Coping Strategies – Specific* (SACS-Specific) is a 72-item behavioral self-report questionnaire developed to assess participants' use of specific academic coping behaviors. Like the SACS-General, this instrument also assesses the broad domains of Corno and Kanfer's (1993) model of volitional control strategies by measuring students' use of Emotional and Motivational Control Strategies, Environmental Control Strategies, and Metacognitive Control Strategies in accordance with the differentiated sub-factors of Knowledge and Regulation of Academic Coping. Each of Corno and Kanfer's (1993) Volitional Control Strategies, and the sub-categories just reviewed, are represented in the SACS-Specific.

The latter measure differs from the SACS-General in two ways. First, each Volitional Control Strategy and constituent sub-strategies is comprised of a greater number of more detailed and specific academic coping behaviors. Second, each Volitional Control Strategy and constituent sub-strategy includes a single behavioral item representing a maladaptive form of a specific academic coping behavior. Consistent with the former measure, each item on the SACS-Specific is rated on a point scale corresponding to the number of courses to which a coping strategy is regularly implemented. As before, individual item ratings typically range from 0 (*In none of my courses*), to 5 (*In five of my courses*). Participants' total scores on the SACS-Specific range according to the number of courses for which the participant is enrolled. Higher scores on the instrument reflect enhanced use of general academic coping strategies.

Because each category-cluster in this measure also has one negatively scored item assessing a less adaptive specific academic coping behavior, a given student's total score can be reduced by implementing such negative behaviors.

Each of the instrument's strategy-clusters is composed of specific component behaviors that provide a more high-fidelity measure of undergraduates' academic coping. At the level of Emotional Control Strategies (5-items), students respond to items tapping the manner in which they have controlled their emotional experience during their first semester at college. Examples of specific academic coping behaviors related to Emotional Control Strategies include the extent to which a student has: (a) re-appraised a disappointing situation by attending to what could be learned from the experience; (b) sought out emotional support and encouragement from their peers, friends, or family; and (c) analyzed distressing concerns and proposed a rational course of action to solve the problem. Corresponding examples of Motivational Control Strategies (11-items) include the extent to which a student has: (a) interspersed low and high interest material during study; (b) provided oneself reinforcement with personally meaningful material rewards; and (c) taking breaks from necessary, but boring course-related activities. The Environmental Control Strategies section (5-items) is comprised of specific academic coping behaviors including: (a) specifically designating places for course materials; (b) reducing competing activities by maintaining an uncluttered desk or workspace; and (c) reducing enticing distractions by having turned off the phone, radio, or television.

In the Metacognitive Control Strategies' (50-items) Knowledge of Academic Coping section of the survey (25-items), Scientific Reasoning Strategies (4-items)

include specific behaviors such as: (a) thinking things out for oneself, not just accepting what has been presented; (b) following the Instructor's argument and seeing the reasoning behind each main aspect; and (c) examining the evidence carefully and then reaching one's own conclusions about the course material. Examples of specific academic coping behaviors comprising Structured Learning with Memory Techniques (6-items) include: (a) re-stating or re-explaining answers to study questions, relationships between topics, or steps to solve problems; (b) elaborating on course material when studying by providing additional facts and/or specific examples, key words, symbols, phrases, etc.; and (c) using association strategies like acronyms or silly sentences to help remember course material better. Finally, examples of specific academic coping behaviors tapping Organized Study and Learning Strategies (15-items) include: (a) checking to ensure understanding of the grading criteria and one's performance during the semester; (b) taking accurate, organized, and legible notes during lectures and while reading: and (c) braking studying time into smaller steps.

Specific academic coping behaviors in the Regulation of Academic Coping (25-items) are similarly represented in the SACS-Specific. Therefore, examples of specific behaviors in the Planning and Executing Academic Coping section (7-items) include: (a) planning coursework with the end or goal in mind; (b) setting specific goals before beginning an academic task; and (c) accurately gauging the amount of time to carry out various course-related activities. Examples of the Self-Monitoring of Academic Engagement and Comprehension (8-items) include: (a) reviewing portions of the text and lecture notes, circling or highlighting key concepts and facts that answered self-derived

questions; (b) keeping an accurate gauge of passing time while working on course material; and (c) frequently asking oneself, "What should I be doing now?" Finally, specific behaviors related to academic coping strategies associated with Self-Evaluation and Correction (10-items) include: (a) periodically reviewing material to evaluate one's comprehension of course material, important relationships, etc.; (b) asking oneself if there was an easier way to do things after finishing an academic task; and (c) asking oneself if one considered all the options after finding a solution to a problem.

As indicated, each category-cluster also includes an item related to less adaptive coping. This is because individuals with ADHD symptoms may proactively implement less efficient academic coping behaviors that are less likely to be part of a more coherent strategy. For example, in the Knowledge of Academic Coping, less adaptive specific behaviors include: (a) seeking out emotional support from anyone that would listen, so that one could vent one's feelings; (b) haphazardly doing the first scholastic task one could think of; and (c) waiting for an impending deadline to "force" one to finish school work. Similarly, in the Regulation of Academic Coping, less adaptive specific behaviors include: (a) addressing problems as they arose and without much forethought; (b) devoting time to doing coursework and little attention to how one was completing coursework; and (c) waiting to evaluate academic performance until the end of the semester when grades are posted.

ADHD Symptoms

The diagnostic reliability and validity of adults' self-reported ADHD symptoms has been a point of mild controversy. To date however, a wealth of data suggests that adults with ADHD provide reliable and valid information regarding their symptoms of ADHD and associated deficiencies in executive functioning (Conners, 1998; Mehringer, Downey, et al., 2002; Murphy & Schachar, 2000; O'Donnell, McCann, & Pluth, 2001). The *Current Symptom Scale* and the *Childhood Symptom Scale* (Barkley & Murphy, 1998) will be used to respectively assess participants' self-reported current and childhood ADHD symptoms. Each of these measures is based upon the *ADHD Rating Scale – Version IV* (ADHD-IV; DuPaul, Anastopoulos, & Power, 1998), which closely follows the current *DSM-IV* (APA, 1994) diagnostic criteria, and has been stratified, normed, and standardized on individuals with ADHD from childhood through young adulthood (DuPaul, Anastopoulos, & Power, 1998).

The *Current Symptoms Scale* and *Childhood Symptoms Scale* each contain 18 items for ADHD from DSM-IV in a self-rating scale. These complementary instruments are closely based on the ADHD-IV rating scales, although several items have been reworded slightly for clarity and brevity. Each item is rated on a four-point scale ranging from 0 (*never or rarely*), 1 (*sometimes*), 2 (*often*), to 3 (*very often*). The scales were used with adult populations (Barkley & Murphy, 1996; Lerman, Audrain, Tercyak, et al., 2001), and have demonstrated acceptable levels of internal consistency and excellent test-retest reliability (r = .82) (Aycicegi, Dinn, & Harris, 2003). Summary scores have been shown to predict ecologically valid adverse outcome such as reduced motor vehicle

driving quality (Barkley, Murphy, & Kwasnik, 1996). The *Current Symptoms Scale* (CSS) also evidences sensitivity to changes in ADHD symptom level during prescription trials (Paterson, Douglas, Hallmayer, et al., 1999).

Academic Performance

Concurrent and cumulative Grade Point Average (GPA), number of problem courses, and hours completed were collected from the Registrar's Office, serving as indices of academic outcome. Problematic courses comprised the sum of participants' failing grades, incomplete courses, and withdrawn courses at the end of the concurrent and cumulative semesters.

Scholastic Aptitude

In the proposed investigation, specialized ability tests, including the *Scholastic Assessment Test* (SAT; College Board, 1995) and the *American College Test* (ACT; American College Testing Program, 1994) were used as indices of intellectual ability. These measures are preferred over other ability measures normed on the general population because the tests are particularly sensitive to college applicants, who are brighter and more homogeneous in ability and achievement, as compared to the adult population at large (Crouse & Trusheim, 1988). This approach has also received favorable regard in the ADHD literature (e.g., Glutting, Monaghan, Adams, & Sheslow, 2002).

Exclusion Criteria

In order to rule out potential confounds in the evaluation of the proposed model, several features necessitated participant exclusion from participation in this study.

Participants answered questions concerning demographic variables and their medical history to determine eligibility. Participants with a history of neurological disorders (other than ADHD), or severe psychiatric disorders were excluded from participation in this study. Neurological conditions often present with symptoms associated to ADHD (Pearl, Weiss, & Stein, 2001) and may further reduce the strength of inference from this study's findings. Therefore, a careful review of participants' medical history was conducted using the *Health History Questionnaire* (Barkley & Murphy, 1998) to rule-out potential participants that may have impaired executive functioning for other reasons than those associated with ADHD symptoms. Several undergraduates were excluded from study participation on this basis. Severe psychiatric disorders involving anxiety or mood disturbance so often involve disruption of attentional processing and concentration that these symptoms have become diagnostic criteria belonging to these syndromes (APA, 1994). To identify and exclude participants with severe anxiety or mood disturbance according to accepted cut-offs, the *Beck Anxiety Inventory* (BAI; Beck & Steer, 1990) was used to quantify the extent of participants' anxiety symptoms (severe range > 31), whereas the *Mood Assessment Scale* (MAS; Yesavage, Brink, Rose, Lum, et al., 1983) was used to evaluate the level of participants' depression symptoms (severe range > 20). As indicated, problems with comorbid anxiety and depression are common among those with ADHD; only students with severe affective disorders, as indicated by relevant cut-off scores, were excluded from participation in this study. Mild to moderate levels of affective disturbance (BAI score < 32; MAS score < 21) were used in secondary exploratory mediation analyses and as covariates in the group comparison analyses.

Neurological and Medical Conditions. Demographic information, recent alcohol and substance use, and medical and neurological history were evaluated with the following semi-structured clinical interview. During the telephone screen, each potential participant received a structured clinical interview from a modified version of the *Health History Questionnaire* to establish each potential participant's preliminary inclusion or exclusion from the study. The *Health History Questionnaire* is a brief measure designed to quickly gather information regarding a patient's medical history. Participants responded to 15 medical conditions (e.g., serious head injury, injury resulting in a loss of consciousness, thyroid condition, etc.) in a Yes-No checklist format. Additionally, participants were asked whether or not they have received a diagnosis for a learning disability, and whether or not they have used alcohol or another substance in the 48-hours before the time of testing. These transcripts constitute the bulk of the telephone script in the preliminary telephone screen interview. All questions were phrased in such a way that they refer to the potential participants' childhood, past as an adult, and currently.

Psychiatric Co-morbidity. The *Beck Anxiety Inventory* (BAI; Beck & Steer, 1990) is a 21-item self-report measure that assesses the severity of current symptoms of anxiety. Participants responded to each item on a 4-point Likert scale ranging from 0-3, the sum produces the total score. The BAI exhibited internal consistency (r = .94) with adequate test-retest reliability (r = .75 at one week, and r = .67 at two weeks) (Beck & Steer, 1990; Fydeck, Dowdall, & Chambliss, 1992). This measure also has norms for normal student and outpatient psychiatric populations (Beck, Epstein, Brown, & Steer, 1988).

The *Mood Assessment Scale* (MAS; Yesavage, Brink, Rose, Lum, et al., 1983) is a 30-item measure that assesses the severity of current depression symptoms. Although initially designed for use in the evaluation of depression in the elderly, this instrument has been normed for young and middle-aged adults (Rich, 1993 as cited in Spreen & Strauss, 1998). Participants responded affirmatively or negatively to each item. The direction of positive responses to these questions has been sequenced randomly. One point is given for each of the highlighted diagnostic items. This instrument was shown to evidence a high level of split-half reliability (e.g., $r = .94$) (Rule, Harvey & Dobbs, 1989; Yesavage, Brink, Rose, & Adley, 1983) and adequate test-retest reliability ($r = .85$) (Koenig, Meador, Cohen, & Blazer, 1988). Additionally, the instrument demonstrated good convergent validity in a sample of 585 psychiatric adult patients (Rule, Harvey & Dobbs, 1989). It evidenced significant discrimination between mildly depressed patients and non-depressed subjects (Snowdon & Donnelly, 1986; Yesavage, Brink, Rose, Lum, et al., 1983). Shah, Phongsathorn, George, et al. (1992) reported that the MAS yields adequate sensitivity (75%) and specificity (73%). Construct validity is further supported by the instrument's associations with other self-report measures of mood disturbance (Yesavage, Brink, Rose, & Adley, 1983). Independent sources (e.g., Hickie & Snowdon, 1987; Spreen & Straus, 1998) similarly recommended the following cutoff points: normal 0-9, mild depressives 10-19, and severe depressives 20-30.

PROCEDURES

Recruitment of the Participants

The Dean of Students' Office at The University of Texas has agreed to send out confidential emails to undergraduates registered with this office describing the purpose and nature of the study. Contact information was provided so that interested students could anonymously contact the Principle Investigator and learn more about the study before they identified themselves. Students recruited from the Introductory Psychology 301 pool responded to analogous computerized advertisements through the Department of Psychology at The University of Texas. These advertisements asked undergraduates for their participation in this study in exchange for receiving experimental credit in their Psychology course. These recruitment advertisements were included with others displayed in the Department of Psychology for students not in the Introductory Psychology 301 pool.

Potential participants who contacted the Principal Investigator were asked questions concerning demographic variables and their medical history during a brief telephone screening to further determine eligibility. Participants with a history of neurological disorders or severe psychiatric disorders (e.g., Schizophrenia, Bipolar Disorder, a history of suicide attempts) were excluded from participating in this study. The Principal Investigator conducted the brief telephone interviews and scheduled a meeting time for the administration of the study's measures. The telephone interview took approximately 10 to 20-minutes to complete. As noted, these telephone interviews were anonymous until the potential subject decided to participate in the study. When an

undergraduate sought to participate, the subject's information was confidential; student's name was not placed on any of the materials gathered. A confidential code was used to identify each participant's responses on self-report questionnaires and on all other indices.

Information, in the form of the principal investigator's telephone number and e-mail address, was provided so that those interested could contact the principal investigator to enroll. At no time was the identity of students receiving services revealed to study personnel except by the self-initiated contact by the participant. During the testing session, students were asked to sign a release of information from the Office for Students with Disabilities and the Registrar's Office at UT in order to determine scholastic aptitude, access the participants' concurrent and cumulative GPA, problematic credit hours (i.e., credit hours for failing grades, withdrawals, incompletes, etc.), and completed credit hours.

Obtaining Informed Consent

Prior to testing, the principal investigator asked the participant to read and sign the consent form approved by the UT Institutional Review Board. Students were informed that they would be asked to complete two measures concerning whether or not they experience symptoms associated with inattention and hyperactivity. In addition, they were asked to sign a release of information for the Principal Investigator to access their SAT scores, ACT scores, and concurrent and cumulative transcripts from official records at UT. Participants were also told that they would complete two measures of their academic coping in addition to two neuropsychological tests of their executive functions.

Test Administration

Participants were scheduled for one testing session lasting up to 90-minutes. First, participants were administered the *Current Symptom Scale* and *Childhood Symptom Scale* (Barkley & Murphy, 1998) to assess the level of each participant's ADHD symptoms. Administration of these self-report questionnaires was followed by the administration of the *D-KEFS Tower Task* (Delis, Kaplan, & Kramer, 2001) version of the TOH. Participants were then asked to fill out each of the academic coping measures. This was followed by the administration of the PASAT (Gronwall & Sampson, 1974). This sequence was used to avoid interaction effects due to the challenging nature of the PASAT, which has been shown to induce negative affective states (Roman, Edwall, Buchanan, & Patton, 1991). Participants were then administered the BAI and MAS as measures of psychiatric co-morbidity and emotional regulation. After administration of all the measures, the examiner answered any questions participants had following the debriefing.

CHAPTER 5: RESULTS

OVERVIEW

Preliminary analyses involved examination of the distribution of demographic statistics, potential interpretive confounds from demographic variables for group comparisons, and the construct validity of the core study variables. Primary analyses targeted the four primary study hypotheses related to the proposed model. Due to the lack of empirical support for key components of the proposed model, not all of the anticipated mediational analyses were performed. This is true particularly in relation to the measurement and structural components of the SEM proposed earlier. Exploratory mediational analyses were conducted on the basis of the study's findings, in an effort to extend understanding of the relation between ADHD symptoms, emotion regulation, and academic outcome indices.

The preliminary analyses addressed demographic statistics, ADHD symptom ratings in childhood and adulthood, as well as distributional characteristics for the total sample ($N = 111$). Discrete groupings based upon participants' ratings of ADHD symptoms in childhood and adulthood were compared. Participant ADHD symptom ratings presented in Tables 3 and 4 were used to group the participants' childhood ADHD symptom ratings ($N = 105$) and adult ADHD symptom ratings ($N = 101$) separately. These data were partitioned further into child Normative Control ($N = 84$) and child ADHD groups ($N = 21$), as well as adult Normative Control ($N = 83$) and adult ADHD groups ($N = 18$). Preliminary analyses were conducted on potentially confounding discrete and continuous demographic variables. Chi-square tests and one-way ANOVAs

were performed for demographic variables among Normative Control and ADHD groups' ratings for childhood (N = 105) and adulthood (N = 101), respectively. Neither discrete nor continuous variables evidenced significant differences among childhood or adult ADHD Normative Control or ADHD groups. Preliminary analyses then examined the concurrent validity of the study's core variables of interest. In order to investigate the concurrent validity for each construct of interest, zero-order correlations were calculated for the total sample (N = 111), and for group comparisons when indicated.

The primary hypothesis-driven analyses involved testing sequentially the four study hypotheses pertaining to the proposed model. Continuous ADHD symptom data and discrete ADHD syndrome data were used across indices to evaluate relevant study hypotheses. For example, Hypothesis 1 stated that ADHD symptoms negatively predict academic outcome. Continuous ADHD symptom data from the total sample (N = 111) were compared with concurrent and cumulative academic outcome indices first using zero-order correlations. Zero-order correlations for continuous ADHD symptom data among the respective childhood and adult Normative Control and ADHD groups were similarly conducted. Then the simple and combined influence of the predictor variables childhood ADHD inattention and hyperactive-impulsive symptoms were evaluated by regression tests run sequentially for concurrent and cumulative academic outcome dependent variables. These analyses were replicated for the adult ADHD inattention and hyperactive-impulsive symptoms as predictor variables. Discrete childhood and adult ADHD syndrome data sets were used in group comparisons between the Normative Control and ADHD groups for the concurrent and cumulative academic outcome indices.

Although empirical support was insufficient to perform the proposed SEM analyses, the study findings suggested two alternate models of mediation. Several exploratory analyses were applied to continuous ADHD symptom data in the form of regression tests and path analysis, while univariate ANCOVAs were used to examine group comparisons between the childhood and adult Normative Control and ADHD groups. These resulting models (see Figures 2 and 3) involved the inter-relations between ADHD symptoms, emotion regulation, and academic outcome. These analyses served as a foundation for the construction of a final integrative explanatory model (see Figure 4) highlighting the relationship between dimensions of emotion regulation, their mediation by way of adult ADHD inattention symptoms, and their relation to undergraduates' concurrent academic difficulties (i.e., problem credit hours).

PRELIMINARY ANALYSES

Demographic Descriptive Statistics

The overall sample consisted of 111 undergraduate volunteers. Of the 111 participants, 48 were men (42.9%) and 63 were women (56.3%). At time of entry in the study, 88 participants (78.6%) were university students in their first year with the remaining 23 students (20.5%) beginning their sophomore year. Participants' at the time of the study were aged from 18 to 20-years (X = 18.38, SD = .60). The sample was ethnically diverse and representative of the undergraduate body with major racial/ethnic categories represented as follows: (a) 65 were White/Caucasian (53%); (b) 33 were Hispanic/Latino (28.6%); (c) 6 were East Asian/Indian (5.4%); (d) 2 were Black/African

American (1.8%); and (e) 7 were Other/Not Otherwise Specified (6.3%). Participants also represented broadly several academic schools across the university. Participants reported enrolling in the following Schools: (a) 26 were Undeclared General (23.2%); (b) 22 in Liberal Arts (19.5%); (c) 19 in Natural Sciences (16.8%); (d) 5 in Fine Arts (4.5%); (e) 12 in Business (10.6%); (f) 4 in Communication (3.5%); (g) 2 in Pharmacy (1.8%); (h) 3 in Engineering (2.7%); (i) 8 in Nursing (7.1%); (j) 8 in Education (7.1%); and (k) 2 in Social Work (1.8%). Participants reported a robust family history of education, the primary index of SES. For example: (a) 44 participants listed one or more parents with a post graduate degree (39.3%); (b) 38 students reported one or more parents with a college education (33.9%); (c) 16 listed one or more parents with "some" college education (14.3%); (d) 7 reported both their parents graduated from high school (6.3%); (e) 1 reported at least one parent who graduated high school (.9%); and (f) 5 reported neither of their parents had graduated from high school (4.5%). These data suggest that this sample's SES is above the national average. At the same time however, the overall sample's scholastic aptitude as indexed by SAT-I combined scores only met the minimum criteria for entry at The University of Texas (X = 1203, SD = 156). The SAT-I scores among Normative Controls (X = 1203, SD = 150) and participants with ADHD in childhood (X = 1198, SD = 180) resembled those of the Normative Controls (X = 1205, SD = 149) and participants with ADHD in adulthood (X = 1161, SD = 167).

Sample Distributional Characteristics

Each of the study's hypotheses was examined from the perspective of participants' ratings of continuous ADHD symptoms on the one hand and discrete ADHD

syndrome groupings on the other. In the latter instances, a clinically diagnosed subset of ADHD individuals was compared to a Normative Control group. The ADHD group was based on self-ratings of current ADHD symptoms and also by retrospective self-ratings of symptoms present during childhood. Of the 111 undergraduates who participated in the study, only 18 entered with professional evaluation, a prior diagnosis, and psycho-stimulant or therapist-guided treatment (e.g., Behavioral Treatment, Talk Therapy, "Coaching", etc.). Participants with a significant history of ADHD (e.g., previous diagnosis and treatment), but who did not meet research criteria for the diagnostic group were excluded from membership in the Normative Control group. This reduced the sample of the childhood ADHD discrete data set to 105 participants (ADHD group, $N = 21$; Normative Control group, $N = 84$). The same approach to maintaining the parameters of the Normative Control group for the adult ADHD data set reduced the sample to 101 participants (ADHD group, $N = 18$; Normative Control group, $N = 83$). Tables 3 and 4 present summary data concerning participants' ratings of ADHD symptoms in childhood and adulthood, respectively. The demographic distributional characteristics (i.e., discrete, continuous, and historical) for participant ratings of childhood ADHD symptoms are presented for in Tables 5 through 7, respectively. The same indices are presented for adult ADHD symptoms in Tables 8 through 10.

Group Comparisons on Demographic Variables

Analyses were conducted separately for the single factors of childhood and adult ADHD diagnostic status. Discrete and continuous demographic variables were explored with Chi-squared tests as well as ANOVAs, respectively. Both Chi-square tests and

separate one-way ANOVAs revealed no main effects for any of the demographic variables across childhood and adult ADHD diagnostic groups. These results indicate that subsequent group differences could not be attributed to systematic differences across groups resulting from these variables.

ADHD Symptoms and Emotion Regulation. As shown in Tables 11 and 12, self-reported ratings of childhood ADHD symptoms and adult ADHD symptoms by the total sample showed robust relationships with emotion regulation indices. Childhood ADHD inattention (r = .43), hyperactive-impulsive (r = .43), and total symptoms (r = .47) were slightly more negatively related to depression symptoms (MAS) than anxiety symptoms (BAI); childhood ADHD inattention (r = .19), hyperactive-impulsive (r = .35), and total symptoms (r = .29). In contrast, the adult ADHD symptom indices were robustly related to both emotion regulation indices. Adult ADHD inattention (r = .52), hyperactive-impulsive (r = .42), and total symptom (r = .51) ratings were positively and strongly related to MAS ratings. These associations were only slightly reduced for the BAI although consistency from the adult ADHD inattention (r = .45), hyperactive-impulsive (r = .35), and total (r = .43) symptom ratings, remained.

Tables 13 and 14 present the correlations between ADHD symptom ratings and emotion regulation indices among Normative Controls during childhood (N = 84) and adulthood (N = 83), respectively. For Normative Controls' childhood ADHD ratings, only childhood ADHD hyperactive-impulsive (r = .28) and total symptoms (r = .22) showed a positive relationship with emotion regulation, both correlating with the anxiety symptoms (i.e., BAI). The adult inattention symptoms among the Normative Controls

were associated with each of the emotion regulation indices, including depression symptoms (i.e., MAS, $r = .35$), depression symptoms without symptomatic overlap ($r = .22$), and anxiety symptoms ($r = .46$). Adult hyperactive-impulsive symptoms for this sub-sample were only related to anxiety symptoms ($r = .27$). Adult ADHD total symptoms were related to both depression symptoms ($r = .30$) and anxiety symptoms ($r = .43$). In general, however, higher ratings for ADHD symptoms were positively associated with higher levels of depression symptoms and particularly anxiety symptoms.

The influence of emotion regulation was also examined for the discrete diagnostic participant groups. Tables 15 and 16 present the results for one-way ANOVAs for the emotion regulation indices across the Normative Control and ADHD groups during childhood ($N = 105$) and adulthood ($N = 101$). Robust group differences were found for the childhood ratings across depression symptoms (i.e., MAS, $F(1,104) = 27.53$, $p < .01$), depression symptoms without symptomatic overlap ($F(1,104) = 18.6$, $p < .01$), and anxiety symptoms (i.e., BAI, $F(1,104) = 7.19$, $p < .01$). This pattern was consistent for the adulthood ratings across the same dependent variables: depression symptoms ($F(1,100) = 24.16$, $p < .01$), depression symptoms without symptomatic overlap ($F(1,100) = 15.51$, $p < .01$), and anxiety symptoms ($F(1,100) = 10.82$, $p < .01$). Across analyses, the ADHD group consistently evidenced more depression symptoms, depression symptoms without symptomatic overlap, and anxiety symptoms relative to Normative Controls.

The meaning of these continuous and discrete relationships warrants examination of the childhood and adulthood ratings of the total sample considered in relation to the

Normative Control and ADHD groups. As presented in Table 17 for the total sample, concurrent academic outcome showed statistically significant relationships with emotion regulation indices. In each case, the emotion regulation indices were significantly and positively related to concurrent problem credit hours: depression symptoms (r = .21), depression symptoms without symptomatic overlap (r = .22), and anxiety symptoms (r = .27). As presented in Table 18, this pattern is not sustained for cumulative academic outcome. Rather, only the anxiety symptoms continue to show a positive relation to problem credit hours (r = .27). Thus, for the total sample, emotion regulation indices are generally associated with problem credit hours concurrently, but only anxiety symptoms continue to relate as strongly with participants' academic outcome at follow up.

The nature of these findings becomes clearer with a closer examination of the associations between participants' concurrent and cumulative academic outcome and their ratings of emotion regulation. Tables 19 and 20 present related concurrent academic outcome findings for the childhood Normative Control and ADHD groups, respectively. This initial comparison reveals a pattern that is sustained from the childhood through to the adult ratings. Among the Normative Controls, the BAI showed a negative relation to concurrent GPA (r = –.22) and a positive relation to concurrent problem credit hours (r = .26). These data indicate that anxiety symptoms have a negative influence on academic outcome. For this sample, neither of the depression symptom indicators showed the same pattern. In contrast, the childhood ADHD group evidenced robust positive associations between concurrent problem credit hours and their ratings of depression symptoms (r = .48) and depression symptoms without symptomatic overlap (r = .55),

respectively. Thus, for this clinical subgroup, higher rates of mood disturbance were related to more concurrent problem credit hours.

As presented in Table 21 anxiety symptoms were similarly related to both concurrent GPA ($r = –.22$) and concurrent problem credit hours ($r = .27$) for the adult Normative Controls. By contrast, Table 22 shows the adult ADHD group evidenced significant positive associations between concurrent problem credit hours for depression symptoms ($r = .54$) and depression symptoms without symptomatic overlap ($r = .62$). Thus, for concurrent academic outcome, the child and adult Normative Controls appear to show more anxiety-related negative relation to their academic outcome, while the ADHD groups report more mood disturbance related to theirs.

Table 23 shows that childhood Normative Controls' anxiety symptoms did not retain their negative association with GPA when measured cumulatively. However, cumulative problem credit hours retained a positive correlation, of equivalent magnitude ($r = .25$), with anxiety symptoms. As Table 24 presents, problem credit hours measured cumulatively continued to be positively associated with the childhood ADHD group's ratings of depression symptoms without symptomatic overlap ($r = .45$). Additionally, this group's ratings of anxiety symptoms were associated with cumulative problem credit hours ($r = .47$).

The pattern of childhood ratings among the Normative Controls was replicated for the adults in the same group (see Table 25). Only anxiety symptoms were associated with cumulative problem credit hours ($r = .25$) at follow-up. However, as presented in Table

26, adults with ADHD showed a significant relation between only cumulative problem credit hours and depression symptoms without symptomatic overlap (r = .53).

Zero-Order Correlations among Variables' within Construct Domains

Zero-order correlations were examined among all variables, within construct domains. Findings are presented in Tables 27 through 37, respectively. These zero-order correlations examine whether the patterns of inter-correlations among study variables within construct domains correspond to the predicted model. Because intra-domain correlations are essentially descriptive, probability levels are not reported. As anticipated observed variables from a related construct were more highly inter-correlated than those related to other constructs, and it was found that the observed variables showed a level and a direction of inter-relationships consistent with the study hypotheses.

ADHD Symptoms. ADHD inattentive, hyperactive-impulsive, and total ADHD symptom are presented in Table 27 with a high degree of consistency among the total sample's ratings of childhood behavior. The same is true in Table 28 for adult ADHD symptom indices. As shown, strong positive associations for symptom clusters and overall ADHD symptoms range typically from r = .75 to r = .95. Consistency of this magnitude indicates that a higher level of clinically significant inattention symptoms during one period in a participant's life is associated with more hyperactive-impulsive and total symptoms for that same period.

Ratings of childhood ADHD symptoms are also consistently related when examined for the Normative Control and ADHD groups, respectively. These data are presented in Tables 29 and 30.

Ratings of adult ADHD symptoms are similarly related when examined for the Normative Control and ADHD groups, respectively. These data are presented in Tables 31 and 32.

Academic Outcome. As predicted, Tables 33 and 34 show that GPA and problem credit hours are inversely related, on the order of $r = -.60$ to $r = -.70$ from participants' concurrent semester to cumulative term (24-months later). This indicates that a higher concurrent or cumulative GPA is more likely to be associated with a corresponding reduction in the number of problem credit hours. In that these variables assess academic performance and academic difficulties, partially independent constructs, this makes sense as a higher GPA reflects greater academic achievement whereas more problem credit hours reflect more pervasive academic difficulties. Of note, a conceptual and empirical relationship exists between GPA and problem credit hours, as each taps failing credit hours. For these concurrent variables, which show effects later in the present study, zero-order correlations were –.59 ($p < .01$). This inter-correcation is only slightly diminished to –.48 ($p < .01$) in the partial correlation between concurrent GPA and problem credit hours controlling for failing credit hours. This reflects a conceptually meaningful inter-correlation between concurrent GPA and problem credit hours, afer removing any potential statistical artifact due to shared influence of failed credit hours.

Tables 33 and 34 show that across concurrent and cumulative data collection points a stronger inverse relationship exists between undergraduates' GPA and problem credit hours, in contrast to the less pronounced relation between either variable and completed credit hours. No significant relation was apparent for either of the latter

pairings during concurrent data collection. In contrast, cumulative GPA was found to have a positive association (r = .32) to completed credit hours, whereas problem credit hours revealed a significant, yet modest, negative relationship to this outcome variable (r = –.19). These results suggest that, over time, a higher GPA shows a moderate parallel in overall average completed credit hours. Further, the more cumulative problem credit hours reported by an undergraduate, the fewer collegiate hours that the student is likely to have completed.

Academic Coping. Table 35 presents the zero-order correlations, means, and standard deviations for the heterogeneous behaviors comprising the academic coping indices. Higher ratings on academic coping strategies and behaviors reflect more frequent utilization of these adaptive coping approaches. In contrast, a higher level of maladaptive academic coping behavior utilization represents participants' use of less effective, less efficient, and largely environmentally-determined coping approaches. The academic coping discrepancy score is a difference score between the proportion of reported academic coping strategies and academic coping behaviors being utilized by participants. A higher academic coping discrepancy score represents then a relative disjoint between the student's application of academic coping strategies and academic coping behaviors. This variable could be regarded as an index of behavioral follow through. Thus, a higher score means a greater discrepancy between academic coping behavior follow through on self-reported academic coping strategy use. As expected, Table 35 shows that there exists a strong positive association (r = .82) between the rate of academic coping strategy and academic coping behavior utilization reported by undergraduates. A weaker positive

association (r = .25) exists between participants' self-reported rate of academic coping strategy and maladaptive academic coping behavior utilization.

Executive Function. The correlation, means, and standard deviations for the executive function indices are presented in Table 36. A higher score for each index indicates a better degree of attentional control or planful problem solving ability, respectively. As anticipated, the PASAT and TOH show a low-to-moderate positive inter-relation reflecting the broader construct, executive function (r = .39). This finding indicates that the instruments assess separate but related aspects executive function.

Emotion Regulation. The correlations, means, and standard deviations for the emotion regulation indices are presented in Table 37. For both measures, higher scores reflect less control over emotion regulation. As anticipated, the MAS and BAI show a strong inter-relation for the construct, emotion regulation (r = .59). The MAS inventories depression symptoms (i.e., mood disruption), whereas the BAI assesses anxiety symptoms. Each of these observed variables may therefore tap separate but related aspects of the construct, emotion regulation.

PRIMARY ANALYSES

ADHD Symptoms and Academic Performance

Hypothesis 1. It was predicted that ADHD symptoms would negatively predict academic performance. This hypothesis received partial support from the data gathered in this study.

ADHD Symptoms and Concurrent Academic Outcome. Hypothesis 1 posited that ADHD symptoms would be negatively associated with academic outcome, measured concurrently. Contrary to study hypotheses, childhood ADHD symptom ratings among the total sample were not correlated with concurrent academic outcome indices. Inattentive, hyperactive-impulsive, and total childhood ADHD symptoms were not significantly correlated with concurrent GPA, problem credit hours, or completed credit hours. In contrast, adult ADHD symptoms ratings did show significant relationships to the academic outcome indices. As shown in Table 38, adult inattentive ADHD symptoms inversely related to concurrent GPA ($r = –.21$) and positively to concurrent problem credit hours ($r = .31$). These associations suggest that more adult ADHD inattention symptoms are related to a lower concurrent GPA on average, and conversely more concurrent problem credit hours. This pattern of results provides partial support for the study's hypotheses. However, adult ADHD hyperactive-impulsive symptoms were not shown to have a significant relationship with concurrent academic outcome indices. When these symptoms were summed for the total ADHD symptoms variable, adult ADHD symptoms showed a pattern of associations in the expected direction across concurrent GPA, problem credit hours ($r = .24$) and completed credit hours ($r = –.16$).

Although the former relationship did not meet statistical significance, the latter two did indicating that a higher level of adult ADHD symptoms is associated with more concurrent problem credit hours as well as less concurrent completed credit hours.

This hypothesis was also examined with correlation analyses for the four sub-groupings across childhood and adult ADHD symptom ratings. Contrary to expectation, only the adult Normative Control ratings of adult ADHD symptoms were related to concurrent academic outcome. As presented in Table 39 adult inattention symptoms ratings showed a negative relationship to concurrent GPA ($r = -.41$). These ratings were also positively related to concurrent problem credit hours ($r = .43$). A similar pattern, although of lesser magnitude was found between ADHD total symptoms and concurrent GPA ($r = -.31$) and problem credit hours ($r = .32$), respectively. These findings indicate that among Normative Controls, adult ADHD inattention symptoms appear to be the most strongly related to concurrent academic outcome indices. Further, the absence of significant relations between ADHD symptoms and academic outcome runs counter to expectations.

Regression analyses were conducted to further test this hypothesis. An emphasis was placed, in these analyses, on discerning the relative contribution of ADHD inattentive and hyperactive-impulsive symptoms on concurrent academic outcome. To examine the combined effects of ADHD inattention and hyperactive-impulsive symptoms as predictor variables, two sets of regression analyses were conducted. Symptoms were examined separately for childhood and adulthood ADHD ratings. Concurrent GPA, concurrent problem credit hours, and concurrent completed credit hours were specified as

the dependent variables. When the first set of analyses regressed the dependent variables on childhood inattention and hyperactive-impulsive ADHD symptoms, no significant predictive relationships were established. More specifically, neither childhood ADHD symptom cluster demonstrated significant independent contribution to academic outcome after controlling for the other.

Table 40 presents regression test statistics when concurrent GPA is regressed upon the total sample's adult ADHD ratings. Adult ADHD inattention symptoms negatively predicted concurrent GPA after controlling for the influence of adult hyperactive-impulsive symptoms (Standardized $\beta = -.35$, $p < .05$). Hyperactive-impulsive symptoms, however, did not continue to predict concurrent GPA once controlling for adult ADHD inattentive symptoms ($p = .16$). These data indicate that ADHD symptoms' association with concurrent GPA is accounted for by participants' adult ADHD inattention symptoms. Table 41 presents these statistics for the corresponding dependent variable, concurrent problem credit hours. Again, adult inattention symptoms predict the dependent variable (Standardized $\beta = .46$, $p < .01$), after controlling for hyperactive-impulsive symptoms. The converse was not the case; adult ADHD hyperactive-impulsive symptoms did not significantly predict concurrent problem credit hours after controlling for inattentive symptoms ($p = .12$). These data indicate that ADHD symptoms' association with concurrent problem credit hours is accounted for by participants' adult ADHD inattention symptoms. Both sets of data implicate a disproportionate role of adult inattentive symptoms in reduced concurrent academic outcome.

ADHD Symptoms and Cumulative Academic Outcome. Hypothesis 1 posited that ADHD symptoms would be negatively associated with academic outcome, measured cumulatively. Contrary to study hypotheses, childhood ADHD symptoms were not correlated with cumulative academic outcome indices. Inattentive, hyperactive-impulsive, and total childhood ADHD symptoms were not significantly correlated with cumulative GPA, problem credit hours, or completed credit hours. In contrast, Adult ADHD symptoms indices did show significant relationships to the academic outcome indices. As shown in Table 42, adult inattentive ADHD symptoms were positively associated with cumulative problem credit hours (r = .18) and negatively related to cumulative completed credit hours (r = –.16). Neither adult ADHD hyperactive-impulsive symptoms, nor total ADHD symptoms similarly associated with cumulative academic outcome indices in these hypothesized ways.

This hypothesis was also examined with correlation analyses for the four sub-groupings across childhood and adult ADHD symptom ratings. Contrary to expectation, only the adult Normative Control ratings of adult ADHD symptoms were related to cumulative academic outcome. As presented in Table 43 adult inattention symptoms ratings showed a negative relationship to cumulative GPA (r = –.28). These ratings were also positively associated with concurrent problem credit hours (r = .35). A similar pattern, although of lesser magnitude was found between ADHD total symptoms and problem credit hours (r = .25). These findings indicate that among Normative Controls, adult ADHD inattention symptoms appear to be the most strongly related to cumulative

academic outcome indices. Further, the absence of significant relations between ADHD symptoms and academic outcome in the ADHD group runs counter to expectations.

To examine the combined effects of ADHD inattention and hyperactive-impulsive symptoms as predictor variables, two sets of regression analyses were conducted. Symptoms were examined separately for childhood and adulthood ADHD ratings. Cumulative GPA, problem credit hours, and completed credit hours were specified as the dependent variables. When the first set of analyses regressed the dependent variables on childhood inattention and hyperactive-impulsive ADHD symptoms, no significant predictive relationships were established. More specifically, neither childhood ADHD symptom cluster demonstrated significant independent contribution to academic outcome after controlling for the other.

By contrast, as shown in Table 44, adult ADHD inattention and hyperactive-impulsive symptom clusters were shown to predict significantly cumulative problem credit hours (R^2 = 4.9%). The adult ADHD inattention symptom cluster predicted unique variation once controlling for hyperactive-impulsive symptoms, (Standardized β = .33, $p < .05$). Neither cumulative GPA (p = .05) nor the cumulative completed credit hours (p = .05) revealed similar predictive patterns, although trends consistent with this pattern were evident. Together, these findings suggest that adult ADHD inattention symptoms accounted for the relationship between adult ADHD symptoms and cumulative problem credit hours.

ADHD Symptoms and Academic Performance: The Mediating Role of Academic Coping

The second set of hypotheses involved three conditions concerning partial mediation of the negative relation between ADHD symptoms and academic outcome. First, academic coping was anticipated to positively predict academic outcome. Second, ADHD symptoms were anticipated to negatively predict academic coping. Third, academic coping was anticipated to partially mediate the relation between ADHD symptoms and academic outcome.

Hypothesis 2a. It was predicted that academic coping would be positively associated with academic outcome. Table 45 presents correlations between academic coping and concurrent academic outcome indices. Two measures of academic coping are positively associated with concurrent GPA, while three evidence negative correlations with concurrent completed credit hours. Concurrent GPA was positively associated with academic coping strategies (r = .26) as well as academic coping discrepancy score (r = .26). Although the former relationship was anticipated the latter ran counter to expectations. These findings suggest, initially, that those undergraduates implementing more broad academic coping strategies obtained a higher GPA at study entry. Further, those participants reporting a larger discrepancy between their application of broad academic coping strategies and specific academic coping behaviors performed better in their coursework at entry. Concurrent completed credit hours were related negatively to self-reported use of academic coping strategies (r = –.28), maladaptive academic coping behaviors (r = –.40), and academic coping discrepancy scores (r = –.26). Counter to

expectation, higher ratings of academic coping strategies were related with fewer concurrent completed credit hours. More consistent with study predictions, higher rates of self-reported maladaptive academic coping behaviors were related to fewer completed hours. A greater academic coping discrepancy score was also related to fewer completed credit hours.

Those reporting Normative Control status in childhood did show significant relationships between their level and type of academic coping and concurrent outcome. Table 46 presents the intercorrelations for these analyses. Concurrent completed credit hours were related negatively to both Normative Controls' ratings of academic coping strategies ($r = –.22$) and maladaptive academic coping behaviors ($r = –.34$). Counter to expectation the former finding indicates that a higher rate of academic coping strategy use is associated with fewer concurrent completed credit hours. Further, these data suggest that for the childhood Normative Controls, higher self-reported use of maladaptive academic coping behaviors is associated with fewer concurrent completed credit hours. Also counter to expectation, a higher academic coping discrepancy score was related to higher concurrent GPA ($r = .34$). In contrast, each of the academic coping indices was associated with a concurrent academic outcome indicator among the childhood ADHD sample (see Table 47). First, and counter to expectation, concurrent completed credit hours were related negatively to ratings of academic coping strategy use ($r = –.49$). More consistent with study predictions, concurrent completed hours were related negatively to maladaptive academic coping behaviors ($r = –.51$), and academic coping discrepancy score ($r = –.49$). Thus, a higher level of maladaptive academic coping

behavior use and a greater discrepancy between use of academic coping strategies and academic coping behaviors were both associated with fewer concurrent completed credit hours. Also consistent with study prediction, this sample's ratings of academic coping behaviors was related positively to concurrent GPA (r = .46).

Correlation data from adult Normative Controls and ADHD groups' ratings of academic coping and their concurrent academic outcome are presented in Table 48 and 49. The former data were similar to that of the childhood Normative Controls. Concurrent completed credit hours were related negatively to both academic coping strategies (r = –.23) and maladaptive academic coping behaviors (r = –.34). Counter to expectation the former finding indicates that a higher rate of academic coping strategy use is associated with fewer concurrent completed credit hours. Further, these data suggest that for the childhood Normative Controls, higher self-reported use of maladaptive academic coping behaviors is associated with fewer concurrent completed credit hours. Also counter to expectation, a higher academic coping discrepancy score was related to higher concurrent GPA (r = .34). Entirely consistent with study predictions, concurrent GPA was correlated positively with the adult ADHD sample's reported use of academic coping strategies (r = .58) and behavior (r = .52).

When correlation analyses between academic coping and cumulative academic coping indices were conducted for the total sample (see Table 50), cumulative GPA and completed credit hours showed statistically significant correlations. First, academic coping strategies were related positively to both cumulative GPA (r = .23) and completed credit hours (r = .21). These findings were consistent with anticipated relations and

suggest that higher self-reported academic coping strategy use was related, prospectively 24-months later, to cumulative GPA and completed credit hours. Further, and also consistent with study predictions, academic coping behaviors were related positively to cumulative completed credit hours (r = .21) two years later. Thus, more self-reported use of academic coping strategies was related to more cumulative completed credit hours.

Childhood and adult Normative Control and ADHD samples showed similar patterns of correlation between academic coping and cumulative academic outcome. Correlations between academic coping and cumulative academic outcome among childhood Normative Control and ADHD samples are presented in Tables 51 and 52, respectively. At 24-month prospective follow-up, cumulative GPA was associated positively with academic coping discrepancy score (r = .23). Contrary to expectation, this sample reported that a discrepancy between their academic coping strategy and behavior use was associated with an augmented cumulative GPA. More consistent with study predictions, the childhood ADHD sample's reported academic coping behavior was related positively to cumulative GPA (r = .45) and inversely to problem credit hours (r = –.52). Thus, higher endorsements of academic coping behavior among the childhood ADHD group corresponded to a higher cumulative GPA. Further, such ratings were related to lower levels of cumulative problem credit hours. Each of these findings could represent a resilience factor for those reporting higher levels of ADHD symptoms.

In like manner to the corresponding childhood analyses, adult Normative Controls showed only a modest relation between academic coping and cumulative academic outcome (see Table 53). Only the academic coping discrepancy score was found to be

significantly related to an academic outcome indicator, cumulative GPA (r = .23). This ran counter to expectations, and as before suggests that for this Normative Control sample, a greater discrepancy between academic coping strategy and behavior use relates positively to cumulative GPA over 24-months. By contrast, the adult ADHD sample reported patterns of academic coping more consistent with study predictions. As presented in Table 54, adaptive academic coping behaviors were related positively to the cumulative academic outcome. Therefore, self-reported use of academic coping behaviors among the adult ADHD group was related positively to cumulative GPA (r = .45) and completed credit hours (r = –.52) and negatively to cumulative problem credit hours (r = –.51). These findings are consistent with the study's predictions. Further, the correlations are not only in the expected direction for each dependent variable, but are also more consistent with the magnitude of relationships expected. Together these findings implicate a significant set of associations between adaptive academic coping and cumulative academic outcome indices for the adult ADHD sample. Further, they provide additional support for the interpretation that such coping efforts might serve as robust resilience factors preserving the ADHD group's academic standing.

Hypothesis 2b. It was predicted that ADHD symptoms would inversely predict academic coping. Tests of this hypothesis involved examination of correlation analyses as well as ANOVAs for childhood and adult sample data. Contrary to the second set of study hypotheses, ADHD symptoms were not systematically related patterns to academic coping among undergraduate participants. As presented in Table 55, maladaptive academic coping behaviors was the most robust correlate of childhood ADHD symptoms,

with small positive associations with each of the childhood ADHD inattentive (r = .20), hyperactive-impulsive (r = .16), and total symptom indices (r = .20). This pattern of findings suggests that childhood ADHD symptoms are not significantly related to the application of broad academic coping strategies or more specific academic coping behaviors. An important exception, however, is that those undergraduates with more self-reported childhood ADHD symptoms from either symptom-cluster tended to show a higher rate of maladaptive academic coping behaviors. Importantly, this result was replicated across the adult ADHD symptom indices (see Table 56) for inattention (r = .36), hyperactive-impulsive (r = .24), and total Adult ADHD symptoms (r = .33). Participants' ratings of adult ADHD symptoms also revealed a significant positive relation to academic coping discrepancy scores (r = .17). This finding points to a relation between higher levels of adult ADHD symptoms and the tendency not to follow through on academic coping strategies with commensurate adaptive academic coping behaviors. Subsequent hypotheses concerning the relations between academic coping and academic outcome indices were not supported further reducing the plausibility of the final mediation hypothesis with two prior conditions failing to be met.

When the relationship between self-reported ADHD symptoms in childhood and adulthood and academic coping was explored among Normative Controls and ADHD groups, similar patterns of results emerged. Childhood Normative Controls reported ADHD inattention, hyperactive-impulsive, and total symptoms unrelated to academic coping indices. By contrast, the childhood ADHD group (see Table 57) data showed a

significant positive association between childhood inattention symptoms and maladaptive academic coping behaviors (r = .48).

The adult Normative Control group showed only modest positive associations between ADHD symptoms and academic coping indices. These relationships are presented in Table 58. Maladaptive academic coping behaviors were positively related to both adult ADHD inattention symptoms (r = .23) and total symptoms (r = .25) for this sample data. This pattern of associations was replicated among the adult ADHD group's ratings of ADHD symptoms and academic coping. Table 59 presents correlations between maladaptive academic coping behaviors and adult ADHD inattention symptoms (r = .58) and total symptoms (r = .48).

This set of hypotheses was also examined for childhood and adult sample data using several one-way ANOVAs with academic coping indices as dependent variables. Childhood Normative and ADHD groups did not differ across adaptive or maladaptive academic coping indices. No differences were found for academic coping strategies (F(1,104) = 1.02, p = .32) or behaviors (F(1,104) = .01, p = .92). Similarly, none were found for maladaptive academic coping behaviors (F(1,104) = 2.97, p = .09) or for the academic coping discrepancy score (F(1,104) = 2.39, p = .13).

Table 60 presents respective data for the adult analyses. Unlike the child analyses, adult ADHD group members reported using significantly more adaptive and maladaptive academic coping relative to their Normative Control peers. Counter to expectation, adults with ADHD reported using more academic coping strategies *(*F(1,100) = 4.66, p < .05). They did not differ in their implementation of academic coping behaviors, however

(F(1,100) = .29, *p* = .59). Consistent with predictions, maladaptive academic coping behaviors, *F*(1,100) = 5.81, *p* < .05, were reportedly higher among the adult ADHD group. Similarly, adults in the ADHD group reported a greater disparity between their self-reported use of academic coping strategy and behaviors, *F*(1,100) = 7.53, *p* < .01.

Hypothesis 2c. It was anticipated that the inverse predictive relationship between ADHD symptoms and academic performance would be partially explained by academic coping. As the correlational data show in Tables 45 to 60, this hypothesis was not supported.

ADHD Symptoms and Academic Coping: The Mediating Role of Executive Functioning

The third set of hypotheses involved three conditions concerning partial mediation of the negative relation between ADHD symptoms and academic coping. First, ADHD symptoms were predicted to be negatively associated with executive function indices. Second, executive function indices were anticipated to be positively related to academic coping indices. Third, executive functions were anticipated to partially mediate the relation between ADHD symptoms and academic coping.

Hypothesis 3a. It was predicted that ADHD symptoms would inversely predict executive functioning. Correlation analyses presented in Table 61 and Table 62 revealed mixed support for the anticipated relations between ADHD symptoms and executive functions. On one hand, the total sample's childhood ADHD symptoms and adult ADHD symptoms were both negatively associated with the PASAT, an index of attentional

control. On the other, neither set of the total sample's symptom indices revealed a robust relationship with the TOH, an index of planful problem solving.

This hypothesis was also tested using the executive function indices as dependent variables with discrete group comparisons for the childhood and adult analyses. A one-way ANOVA comparing childhood Normative Controls to those with ADHD yielded no significant group differences for the PASAT ($F(1,104) = 1.88$, $p = .17$) or TOH ($F(1,104) = .02$, $p = .90$). A one-way ANOVA for the adult sample data was similar for both the PASAT ($F(1,104) = .09$, $p = .09$) or TOH ($F(1,104) = .34$, $p = .37$). Consistent with earlier analyses concerning this hypothesis, executive function indices were not significantly related to ADHD symptoms when examined as a continuous variable or as a full syndrome.

Hypothesis 3b. It was predicted that executive functioning would positively predict academic coping. However, no significant relationships were found between any of the variables for the total sample. As requisite conditions were not met, this hypothesis was not supported.

Hypothesis 3c. It was predicted that executive functioning would partially explain the inverse predictive relationship between undergraduates' ADHD symptoms and academic coping. However, correlation data in Tables 61 and 62 show that no significant relations were found. Similarly, group comparisons show no difference for either executive function index across groups. As requisite conditions were not met, this hypothesis was not supported.

An Integrative Model of ADHD Symptoms and Academic Performance

Hypothesis 4. An integrative model was proposed for the series of expected relationships. The model proposed that executive functioning and academic coping together more fuly mediate the negative predictive relationship between undergraduates' ADHD symptoms and academic outcome. However, as correlational data in Tables 38 to 62 show, requisite conditions were not met, and this hypothesis was not supported.

EXPLORATORY ANALYSES

Adult ADHD Inattention and Emotion Regulation Indices Regressed Upon Academic Outcome

Depression Symptoms. The consistent association between adult ADHD inattention symptoms and academic outcome indices, as well as the robust association between ADHD symptoms and emotion regulation indices prompted a series of regression analyses to investigate further the inter-relation between these variables. When the adult ADHD inattention symptoms and depression symptoms (i.e., MAS) were entered as predictor variables, they predicted significant variation in concurrent problem credit hours (R^2 = 9.6%). Further, as shown in Table 63, once entered into the equation adult ADHD inattention symptoms evidenced a Standardized β = .27, predicting significant variation in the dependent variable after controlling for MAS ($p < .05$). After controlling for adult ADHD symptoms, this relationship was reduced for the MAS variable and no longer significant (Standardized β = .06, p = .55). This pattern of results is consistent with a model in which adult ADHD inattention symptoms mediate the

relationship between depression symptoms as measured by the MAS and concurrent problem credit hours.

In order to ensure that this finding was not an artifact due to symptomatic overlap between cognitive depression symptoms and ADHD symptoms, a corresponding regression test was performed with adult ADHD inattentive symptoms and depression symptoms without symptomatic overlap (see Table 64). Results were similar for concurrent problem credit hours where significant variation was accounted for in the model, (R^2 = 10.2%, $F(1,110) = 5.73$, $p < .01$). Further, adult ADHD inattentive symptoms uniquely predicted the outcome with a after controlling for the influence of the more conservative depression symptom index (Standardized $\beta = .27$, $p < .05$). Further, the association between the latter index and concurrent problem credit hours was reduced and no longer significant (Standardized $\beta = .06$, $p = .55$). This set of relationships is depicted graphically in Figure 2.

Anxiety Symptoms. When an analogous regression analysis was conducted with adult ADHD inattention symptoms and anxiety symptoms (i.e., BAI) entered as predictor variables, they also predicted significant variation in concurrent problem credit hours (R^2 = 11.4%). As shown in Table 65, adult ADHD inattention symptoms predicting significant variation in the dependent variable after controlling for BAI ratings (Standardized $\beta = .23$, $p < .05$). In contrast, the BAI variable did not significantly predict outcome (Standardized $\beta = .16$, $p = .11$). This pattern of results is consistent with a model where adult ADHD inattention symptoms mediate the relationship between anxiety

symptoms as measured from the BAI and concurrent problem credit hours. This set of relationships is depicted graphically in Figure 3.

Integrative Model. These findings points to the role adult ADHD inattention symptoms may play in explaining the predictive relationship between emotion regulation indices and concurrent problem credit hours. In order to better understand the relation of the depression (MAS) and anxiety (BAI) emotion regulation indices to one another and their simultaneous relation to the mediator variable of adult ADHD inattention symptoms, an integrative model was tested. Figure 4 graphically presents the integrative model designed to concisely account for these findings. First, the two independent variables depression symptoms (MAS) and anxiety symptoms (BAI) have a moderate positive association as discussed earlier (r = .59). Second, the MAS (r = .39) and the BAI (r = .22) measures are associated with the mediator variable, adult ADHD inattentive symptoms. Third, the mediator variable is significantly related to the dependent variable, concurrent problem credit hours (r = .29), controlling for both the MAS and BAI measures.

CHAPTER 6: DISCUSSION

OVERVIEW

ADHD Symptoms and Academic Outcome

On the basis of abundant data suggesting that students with ADHD perform below expected levels relative to their peers (e.g., Biederman et al., 1993, 1994; Mannuzza et al., 1991, 1997) and that undergraduates with high, but diagnostically sub-threshold levels of ADHD symptoms are also at increased risk for academic failure (Turnock, Rosen, & Kaminski, 1998), it was predicted that ADHD symptoms in the current sample would negatively predict academic outcome. This hypothesis was examined first for concurrent academic outcome, with ADHD symptoms treated as a continuous variable, and then as a dichotomous variable. Whereas childhood ADHD symptom ratings were not associated with concurrent academic outcome indices, adult ADHD symptoms of inattention were. Adult inattention symptoms showed a negative relationship to concurrent GPA, and a positive relation to concurrent problem credit hours. Thus, higher levels of inattentive symptoms were associated with reduced academic performance and more academic difficulties as participants began their undergraduate education.

When the correlations for discrete Normative Control and ADHD groups were examined across childhood and adulthood ratings, only the adult Normative Control sample showed the expected relationships among academic outcome indices suggesting that sub-threshold levels of ADHD symptoms relate in the expected manner to concurrent academic outcome (i.e., negatively to GPA and positively to problem credit hours). Importantly, however, this relationship was not found in the ADHD group. The lack of

such correlations among the ADHD group's ratings might be explained by the restricted range among this sample's level of ADHD symptoms. Both childhood and adulthood ratings of ADHD were, by definition clinically elevated, and the range of scores was reduced relative to the Normative Controls. Also of note, a disproportionate influence by adult ADHD inattention symptoms was apparent indicating that ADHD inattention symptoms among sub-threshold participants were predictive of concurrent academic performance and difficulties.

This differential influence by adult ADHD inattention symptoms was further supported by regression analyses. Consistent with findings reported earlier, childhood ADHD symptoms ratings were not predictive of academic outcome. However, adult ADHD inattention symptoms were shown to account for the broader predicted relationship between ADHD symptoms and academic outcome. For example, adult ratings of inattention symptoms predicted concurrent GPA and problem credit hours independently of participant ratings of hyperactive-impulsive symptoms. When the long-term outcome of these relationships were explored using the cumulative academic outcome indices, parallel findings was found for the total sample. Childhood ratings continued to be unrelated to academic outcome. However, adult inattention symptoms retained their positive prediction for cumulative problem credit hours. Additionally, they were negatively associated with cumulative completed credit hours. These findings indicate that ADHD inattention symptoms predict prospectively academic difficulties and academic productivity. Specifically, participants' in this sample who reported more inattention during the beginning of college tended to perform with more difficulty

academically (e.g., more failing grades, incomplete courses, number of withdrawn courses, etc.) and with significantly less overall academic progress after two years. Examination for whom this pattern was most prominent among the total sample revealed a disproportionate effect for the adult Normative Controls ratings of adult inattention symptoms. The disproportionate relation between inattention symptoms was again found over time for students' subsequent academic difficulties (i.e., cumulative problem credit hours). Thus, adult inattention symptoms continued to account for the relationship between ADHD symptoms and cumulative academic outcome (i.e., problem credit hours) at 24-month follow-up.

The final tests of the first hypothesis concerned group comparisons for the Normative Control and ADHD groups based upon childhood and adult symptom ratings. In general and contrary to expectation, groups did not differ significantly on the academic outcome dependent variables, concurrently or cumulatively. A lone exception was found for concurrent completed credit hours. Adults with ADHD were found to complete fewer credit hours than their Normative Control peers as they began their college careers. This may indicate that even high-achieving undergraduates with ADHD suffer from reduced academic productivity as they adjust to the workload demanded by college campuses. Although speculative, it may also provide evidence that high-achieving undergraduates with ADHD entering college learn to adapt sufficiently enough to preserve the integrity of their academic performance. These data are consistent with the possibility that these undergraduates similarly reduced the likelihood of their experiencing seriously impairing academic difficulties, and kept themselves on course for a productive college career.

ADHD Symptoms and Academic Performance: The Mediating Role of Academic Coping

As highlighted earlier, recent empirical investigations (Swanson, Harris, & Graham, 2003) as well as comprehensive meta-analyses (Swanson, Hoskyn, & Lee, 1999) suggest that several general academic coping strategies and specific academic coping behaviors facilitate student performance on a host of achievement-related dimensions among undergraduates. It was therefore predicted that academic coping would be positively associated with academic outcome. Because earlier reports (e.g., Turnock, Rosen, and Kaminski, 1998) and more recent empirical support (e.g., Murray & Wren, 2003; Kaminski, Turnock, Rosen, and Laster, 2006) suggest that undergraduates with ADHD and other Learning Disorders utilize less adaptive coping more often, the study's second hypothesis was examined by contrasting adaptive (i.e., use of academic coping strategies and behaviors) and maladaptive approaches (i.e., maladaptive academic coping behavior and academic coping discrepancy).

When examined from this perspective, this hypothesis was partially supported. In general, adaptive academic coping indices predicted better academic outcome. Among the total sample for instance, self-rated use of academic coping strategies were associated positively with participants' concurrent and cumulative GPA. It was also found that participants' self-rated use of academic coping behaviors was associated with more cumulative completed credit hours, or overall academic productivity. As predicted, maladaptive indices tended to show an inverse relation, being related with poorer academic outcome. For example, concurrent completed credit hours were moderately and

negatively correlated with both maladaptive academic coping behaviors and participants' academic coping discrepancy score.

Interestingly, when self-reported academic coping for childhood and adult ADHD samples were examined, the relationships between academic coping indices and academic outcome were even stronger than for the total sample. This was true for concurrent as well as cumulative academic outcome. The adult ADHD sample evidenced a more robust set of associations among their adaptive academic coping and academic outcome. For example, participants evidencing childhood ADHD reported utilizing more academic coping behavior, which was moderately correlated to their cumulative academic performance (i.e., GPA) and inversely related to their academic difficulties, or cumulative problem credit hours. The adult ADHD group members reported similar findings for their use of academic coping strategies and behaviors, which were related across academic outcome indices. Members of this sample reporting ADHD syndrome status appear to provide supporting evidence for the hypothesis that academic coping predicts academic outcome concurrently and prospectively. Furthermore, these findings provide evidence consistent with the proposition that this sample of undergraduates with ADHD may apply effectively their academic coping skills as they manage the difficult transition the starting college.

These findings also relate to the study's next hypothesis, that ADHD symptoms would inversely predict adaptive academic coping. The findings may also bear on the limited literature on the topic. Despite the lack of controlled research specifically investigating academic coping behaviors among undergraduates with ADHD (Handen,

McAuliffe, & Caro-Martinez, 1996; Robin, 1998; Teeter, 1999), several reports of mixed samples of undergraduates with Learning Disorders and/or ADHD indicate that students with ADHD do not use effective coping behaviors (Murray & Wren, 2003; Kaminski, Turnock, Rosen, and Laster, 2006; Wolf, 2001; Wong, Harris, Graham, & Butler, 2003). The earlier findings concerning the relation over time between academic coping and academic outcome among the ADHD group might contrast with the views of others. A number of authors have concluded that students with ADHD exhibit deficiencies in their overall level of academic coping (Nadeau, 1995; Robin, 1998; Teeter, 1999; Wasserstein & Lynn, 2001; Wolf, 2001). Some studies from the ADHD literature even posit that these individuals typically lack the requisite academic coping behaviors necessary for success in a postsecondary academic setting (Mannuzza, Klein, Bessler, et al., 1993; Teeter, 1999; Wolf, 2001).

This study hypothesis did not, however, receive support for the total sample's ratings of childhood ADHD symptoms and adaptive academic coping. That is, the total sample's ratings of childhood ADHD symptoms were not significantly related to either adaptive coping index (academic coping strategies or behaviors). This is more consistent with an investigation of undergraduates with higher levels of ADHD symptoms (Rosen, Tannock, & Kaminski, 1998). Nonetheless, the hypothesis received support in that childhood ADHD inattentive and total symptom ratings were both related positively to maladaptive academic coping behaviors. Further, participants' ratings on the adult ADHD symptom indices were each associated positively with the maladaptive academic coping behavior index. This is consistent with recent reports in the literature (e.g.,

Murray & Wren, 2003; Kaminski, Turnock, Rosen, and Laster, 2006). This finding suggests that, on the whole, this sample's self-ratings of ADHD symptoms (for childhood or adulthood) are related to higher levels of maladaptive academic coping behaviors.

When examined across Normative Control and ADHD sub-samples, this pattern of findings was due in large part to participants' ratings of inattentive ADHD symptoms among the child and adult ADHD groups; an attenuated relation was found among the adult Normative Control sample's ratings. This suggests that the ADHD sample in this study may not only implement adaptive coping approaches with more efficacy than identified in prior research, but that they also report engaging in more maladaptive academic coping behaviors, a finding consistent with previous literature. It may be the case that in this high-achieving undergraduate sample, individuals with ADHD have learned to effectively implement adaptive coping approaches that help to counterbalance the detrimental effects from their maladaptive coping behaviors. Importantly, in spite of the frequency of less adaptive coping among the ADHD group overall, their maladaptive coping behaviors were not predictive of negative academic outcome concurrently or cumulatively. The same was not true for the total sample's ratings however.

When group differences in academic coping were assessed for childhood and adult ratings of ADHD symptoms, no significant differences were evident for the childhood data set. In contrast, the adult ADHD group differed from their Normative Control peers on several academic coping indices. First, the adult ADHD group reported using significantly more academic coping strategies than their Normative Control peers. This ran counter to expectations and is inconsistent with the literature to date. This

finding also continues to lend support to the proposition that undergraduates with ADHD may initially suffer from reduced productivity at college, but implement their academic coping skills to address their academic obstacles. In other words, a group difference in level of academic coping use is consistent with the notion that these higher-functioning adults with ADHD may have learned to adapt to the initial challenge posed by college. In light of the group's prospective academic outcome relative to Normative Controls, this result might indicate the presence of an acquired and learnable resilience factor (i.e., broad academic coping strategies and specific academic coping behaviors). This possibility is consistent with the fundamental tenets of those conducting community-based educational interventions designed to enhance self-directed academic success discussed earlier (e.g., Butler, 1993, 1995, 1998c; Butler, Elaschuk, & Poole, 2000; Butler, Jarvis, et al., 2001; Ellis & Colvert, 1996; Montegue et al., 1997; Harris & Graham, 1996).

In spite of some initial evidence highlighting the potential of such learned adaptation, it is also important to note that the adult ADHD group showed a higher relative academic coping discrepancy score. This indicates that undergraduates with ADHD reported a larger disparity between their use of academic coping strategies and the academic coping behaviors that logistically comprise those strategies. Because academic discrepancy score provides an index of the quality of participants' self-reported academic coping, this finding may indicate that the ADHD group could cope more effectively. That is, although the ADHD group reports using more academic coping strategies their follow through and implementation of the behaviors constituting those

strategies could be improved upon significantly, perhaps further enhancing their academic outcome in college. In spite of these encouraging findings, overall the analyses related to the second set of hypotheses did not generate enough support to test a model of mediation.

ADHD Symptoms and Academic Coping: The Mediating Role of Executive Functioning

The third set of hypotheses concerned mediation, where executive function variables were proposed to partially account for the relationship between ADHD symptoms and academic coping indices. It was hypothesized that ADHD symptoms would inversely relate to executive function indices. Contrary to an abundant literature that suggests that individuals with ADHD frequently suffer from a complex array of executive functioning deficiencies, this hypothesis received only mixed support for the total sample ratings. On one hand, correlation analyses showed a distinct pattern of support for the hypothesis as each of the childhood ADHD symptoms were negatively associated with the PASAT, an index of attentional control. By contrast, no significant relationship was found between these symptoms and the TOH, a measure of planful problem-solving. On the other, the same pattern was found for the adult ADHD symptoms albeit to a lesser degree. Only the ADHD inattentive symptoms were found to be negatively associated with the PASAT, and none of these indices related significantly to the TOH.

The pattern of results between ratings of ADHD symptoms and attentional control (PASAT) might be understood from a developmental perspective. Some developmental

theorists studying ADHD posit that the disorder results from a developmental lag, one that does not persist indefinitely through development (e.g., Hill & Schoener, 1996). To the extent that retrospective ADHD symptoms in childhood are accurate, such an explanation is consistent with a stronger association between ADHD symptoms in childhood and executive functioning, relative to the relation of these symptoms in adulthood. The gap between contemporary functioning (behaviorally and neuropsychologically) and developmental lag is expected to gradually decrease over time and with maturation. Support for this interpretation was mixed when examined with group comparisons. When group comparisons were performed, neither child nor adult ADHD groups differed from their Normative Control peers on the TOH or PASAT. An alternative explanation is that the PASAT was sensitive enough to detect executive function differences along the continuum from high to low symptoms of ADHD.

Another explanation that may account partially for these findings, and more thoroughly for the lack of group differences on the TOH, is the possibility that the high-achieving nature of this sample reflects the reduced likelihood of participants suffering from executive dysfunction. That group differences were not observed among the executive function indices between adults with ADHD and Normative Controls is surprising. Numerous investigations using the TOH (Aman, Roberts, & Pennington, 1998; Klorman, Hazel-Fernandez, Shaywitz, et al., 1999; Murphy, 1999; Pennington, Groisser, & Welsh, 1993) and the PASAT (Jenkins, Cohen, Malloy et al., 1998; Katz, Wood, & Goldstein, 1998; MacLeod & Prior, 1996; Sweitzer, Faber, Grafton, et al., 2000) report large effect sizes among participants with ADHD tested with these

instruments. This pattern in the findings may have less to do with the well-supported sensitivity of these instruments to detect executive dysfunction; rather the present sample of undergraduates with ADHD might reflect a unique sub-sample of adults with ADHD. On one hand this group may not evidence significant executive dysfunction. On the other, they may reflect an unusually bright minority of adults with ADHD. The current admission standards at UT for entering first year students demand scholastic aptitude scores at or above the 98th percentile by national standards. With a sampling of intellectually and cognitively robust undergraduates, the neuropsychological instrumentation may have been compromised by pronounced ceiling effects, particularly for the TOH index. The mean and standard deviations for the TOH and PASAT respectively indicate that there was substantially more variation in participants' responses on the PASAT when compared to the TOH.

The high-achieving nature of the sample warrants caution generalizing these findings to other adults with ADHD. For example, it would not be appropriate to presume that extrapolation would be appropriate to participants with ADHD just finishing High School or perhaps studying at a Community College. This quality of the sample also restricts the extent to which these data can address other matters broached in the literature. For example, numerous authors in the ADHD literature have emphasized that individuals with ADHD do not lack the requisite knowledge or skills for goal attainment and academic success (Barkley, 1994, 1998, 1999; Dawson & Guare, 2004). Rather, these authors have argued individuals with ADHD lack the necessary neuropsychological substrates responsible for the executive functioning that permits efficient and consistent

self-regulation. From this summary it seems reasonable to question the extent to which these propositions apply. Among this sample, adults with ADHD show higher than expected academic coping skills that are correlated with their academic outcome in anticipated directions. Furthermore, these data do not suggest that executive function indices serve as a barrier to the effective implementation of these participants' coping. These data do not facilitate deeper clarification on these matters for less successful students and young adults with ADHD. Nor can they shed light on the proposal that deficiencies in executive functioning by their very nature compromise the acquisition of new knowledge and understanding of academic coping strategies and behaviors (Barkley, 1997, 1998; Dawson & Guare, 2004; Nadeau, 1995; Tannock, Rosen, & Kaminski, 1998). It remains a plausible possibility that deficiencies in executive functioning could hinder the regulation of students' academic coping for less scholastically apt students. For this sample, and contrary to prediction, the executive function indices were not robustly related to academic coping indices. Also counter to hypothesis three, executive function indices were not related to academic outcome.

An Integrative Model of ADHD Symptoms and Academic Performance

An integrative model that builds upon this series of relationships was tested. This model proposed that executive functioning and academic coping together more fully mediate the negative predictive relationship between undergraduates' ADHD symptoms and academic performance. However, the data did not provide sufficient evidence in support of the fourth integrative hypothesis. Instead, the data pointed to an alternative

explanatory model where problems with emotion regulation disproportionately affect those with ADHD.

The relationships between emotion regulation indices and academic performance of adults with ADHD have not been explored directly in the ADHD literature. Considerable evidence points to the importance of such factors, as it is well established that those with ADHD are at elevated risk for both anxiety and mood disturbance (Biederman, Faraone, Spencer, et al., 1994; Downey, Stelson, Pomerleau, et al., 1997). Estimates for psychiatric co-morbidity among adolescents are as high as seventy-five percent (McGee, Williams, & Feehan, 1992), with little appreciable change in adulthood (Mannuzza & Klein, 1999; Weiss, Hechtman, Milroy, & Perlman, 1985; Wilens, Biederman, & Spencer, 2002). Data collected here exhibit consistency with these reports. For instance, the ADHD sub-samples in this study reported approximately twice the level of anxiety and depression symptoms as did Normative Controls. Although the ratings of emotion regulation were below threshold cut-offs and not necessarily clinically significant, findings indicate that such symptoms could affect academic outcome**.**

Indeed, emotion regulation was associated with academic outcome. Anxiety and depression symptoms among the total sample positively predicted concurrent academic difficulties (i.e., concurrent problem credit hours). Participants reporting more symptoms of anxiety and depression were found, on average, to obtain more failing grades, more incompletes in their classes, and to withdraw from their course-load more frequently before the end of the semester. These academic difficulties occurred as most of the students participating in the study began their undergraduate studies. Such symptoms

could reflect a failure of participants with higher levels to cope with academic stress. It was at this stressful time that undergraduates with ADHD reported significantly more problems regulating their emotional lives, and evidenced the least academic productivity during the course of their participation in this study.

Given the relatively low rate at which adults with ADHD enter, are retained in, and graduate from college, measuring the interrelation between putative causal mechanisms that may account for reduced academic outcome has been emphasized. At first glance, the results might implicate the need to implement additional assistance for these students regulating their emotional experiences. While this could help matters building upon their repertoire of coping strategies, it may also be misguided. Further inspection revealed that the emotion regulation indices express their association with outcome by way of adult ADHD inattention symptoms. That is, adult ADHD inattention symptoms mediated the relationship between these indices of emotion regulation and concurrent academic difficulties. This is relevant clinically as emotion regulation indices no longer predicted concurrent academic difficulties after controlling for the prediction by inattention symptoms. It may follow that targeting inattention symptoms of ADHD would be a more potent intervention approach.

This proposal could show a broader application when considering undergraduates with fewer cognitive and academic coping resources to draw upon, than the sample assessed here. The effective management of ADHD inattention could also help to prevent more pernicious academic outcomes as a consequence of indirect associations by anxiety or mood disturbance. This mediational model could be understood as one encompassing a

diathesis-stress framework in which the resources of undergraduates with ADHD will be exceeded as academic demands increase. Whether or not these undergraduates express problems with emotion regulation or not, the more effective means of reducing their emotion dysregulation and protecting them from academic impairment, would be to bolster their regulation of inattention symptoms. It seems likely that factors related to reducing inattention, distractibility, and augmenting attentional focus for those with ADHD, would serve to prevent the negative influence of more serious problems with emotion regulation.

Limitations

In addition to the selective nature of this sample and the restricted generalizability of these findings to other samples, some important limitations warrant consideration. One major factor that restricts the strength of inference from this study pertains to the use of self-report data. Although efforts to broaden the range of study variables were made with aggressive attempts to recruit participants with ADHD, a limited number of participants met diagnostic criteria for ADHD. Further, although several reports document the accuracy of participant report, concurrently and retrospectively, for ADHD symptoms (Conners, 1998; Mehringer, Downey, et al., 2002; Murphy & Schachar, 2000; O'Donnell, McCann, & Pluth, 2001), anecdotal events suggest otherwise. For example, although self-report ratings were collected in accordance with research standards in the ADHD literature, in several instances participant report of ADHD symptoms, diagnostic history, and functional status were inconsistent. Although some participants met rigid criteria in order in order to obtain formal academic accommodations from The UT Service for

Students with Disabilities, the participants did not report on formal instruments enough ADHD symptomatology to meet our research criteria for group membership. In the adult ADHD sample data set this type of problem was related to several participants being excluded from statistical analyses.

A more effective means of assessing ADHD symptomatology might involve use of a structured clinical interview by a seasoned clinician. Although this may introduce issues related to investigator bias, the benefits of an expert assessor appear to supersede the problems with amateur ratings that affect diagnostic status membership. Epistemologically, amateur self-ratings appear an inferior approach to assessing ADHD as compared to that of a structured interview with a well-qualified clinician and by gathering retrospective and concurrent collateral report.

The issue of self-report also may have influenced the assessment of academic coping among undergraduates. Only self-report data were gathered for these indices in the present study. In spite of attempts to develop new measures of academic coping that would effectively map onto current theories of Meta-Cognitive Awareness and show enhanced sensitivity to the academic coping of undergraduates with higher levels of ADHD symptoms, measurement issues remain. In addition to the limits related to self-report data, and despite concurrent report (vs. retrospective), the assessment tools for academic coping were neither based upon actual observation of said coping approaches, nor do they necessarily assess the quality of execution of undergraduate's academic coping broad strategies or specific behaviors. It remains a possibility that self-reported perceptions of academic coping are incongruent with actual behavioral proficiency.

Furthermore, among those with ADHD taking psychostimulant medication, self-reported academic coping may not discriminate between academic coping behaviors and treatment effects per se.

Major Conclusions and Clinical Implications

The present study explicitly sought to assess undergraduates' coping responses during a very stressful period in their lives, as they managed the difficult transition to being an undergraduate. Although the ADHD literature indicates that this transition may be especially difficult for adults with ADHD, limited attention has been allocated to the period of transition involved with matriculation. Recall, adults with ADHD are eleven-times more likely to have dropped out of high school than their normative peers (Mannuzza, Klein, Bessler, et al., 1997), five-fold fewer complete their undergraduate education, and twelve-fold fewer receive a graduate degree (Mannuzza et al., 1997; National Center for Education Statistics, 1996). The present study adds to the literature with several summary findings. The first theme relates to the differential implications of ADHD symptoms for different forms of academic outcome (i.e., performance, difficulties, and productivity). When ADHD symptoms were assessed for, the level of ADHD symptoms and the prominence of symptom-clusters were all related to academic outcome indices. Second, the significance of continuous versus discrete understanding of ADHD symptoms and the full syndrome are discussed. Prior reports highlight the impact of sub-threshold ADHD symptoms (e.g., Turnock, Rosen, & Kaminski, 1998), which also concerns the debate related to adult ADHD following a childhood onset (Biederman, Faraone, Spencer, et al., 1993; Chen, Faraone, Biederman, & Tsuang, 1994; Eiraldi,

Power, Karustis, & Goldstein, 2000; Power, Costigan, Leff, et al., 2001; Power & Eiraldi, 1998; 2000; Reid & Maag, 1994). Indeed, there were disparate consequences whether or not high or low levels of ADHD symptoms were assessed. The results of this study also point to the significant influence of emotion regulation coping skills, or their absence, and the relationship to academic outcome. This is relevant as a reminder to those researching ADHD that disproportionate effects of emotion regulation could pervade the lives of these students. Perhaps more importantly, the influence of ADHD symptoms mediating the relationship between emotion regulation indices and academic outcome is worth highlighting and emphasizing as a discovery in the literature. The clinical implications for this discovery could be pronounced, particularly for students with ADHD who are not as highly achieving. Finally, the impact of academic coping on this sample is discussed with positive and hopeful implications for treatment intervention.

A noteworthy pattern was observed such that concurrent ratings of ADHD symptoms were more often associated with either academic outcome or academic coping indices. Retrospectively reported childhood ADHD symptoms were not as helpful or as often associated with the study variables assessed. This indicates that current ADHD symptoms may serve as a more robust and reliable indicator of outcome indices as measured here. Further, the symptom-clusters of ADHD were differentially predictive of academic outcome. Inattentive ADHD symptoms were disproportionately more influential and predictive of concurrent and cumulative academic outcome even after controlling for hyperactive-impulsive symptoms. This suggests that these cognitive symptoms serve a mechanistic role affecting undergraduates' academic performance (i.e.,

GPA), difficulties (i.e., problem credit hours), and productivity (i.e., completed credit hours). The effects then are not simply a function of level of symptomatology. What is more, in that adult ADHD is more robustly associated with inattentive symptoms than hyperactive-impulsive ones, this calls for careful consideration in undergraduate environments catering to the educational needs of undergraduates with ADHD.

Symptoms of ADHD were found to interfere with academic outcome at the level of continuous symptoms and the discrete level of ADHD as a syndrome. The discrete effects of ADHD were largely evident in the early period of adjustment to school. This implicates the importance of careful monitoring of undergraduates at risk. Further, those with ADHD are particularly likely to benefit from auxiliary resources from the start of their college career, and perhaps a reduced scholastic course load. An important intervention approach highlighting prevention of academic difficulties is called for by these data. By contrast, the significance of continuous or sub-threshold levels of ADHD symptoms were shown to have lasting effects on academic outcome. This also points to the importance of sustained support services for those at such risk.

When planning a treatment intervention to address risk for academic outcome, these data indicate that a helpful approach would be to assess both undergraduate's academic and emotion regulation coping skills. On one hand, this study replicates other work (Kaminski, Turnock, Rosen, & Laster, 2003; Turnock, Rosen, & Kaminski, 1998) suggesting that those with ADHD use disproportionately more maladaptive coping approaches. The data also suggest that continued support helping undergraduates with ADHD or high levels of these symptoms, to follow through with their academic coping

behaviors in order to make the most of the academic coping strategies they are trying to implement. Given the limited assessment of the integrity of undergraduates' coping implementation, a careful assessment of their actual coping skills is recommended.

An additional contribution of this research relates to the pernicious influence difficulties with emotion regulation can have on the academic outcome for those with higher levels of adult ADHD inattention symptoms. Not only were those with ADHD found to have elevated rates of anxiety and depression symptoms, but their primary ADHD symptoms complicated the situation. The ADHD inattention symptom-cluster was found to mediate the pathways of both anxiety and depression symptoms on concurrent academic difficulties. Therefore, with a population so at risk for co-morbid internalizing psychopathology, is will also behoove educators to carefully monitor the emotion regulation of these undergraduates as they traverse their education. Some recent reports support the use of Cognitive-Behavioral Treatment (CBT) strategies among undergraduates with ADHD (Wolf, 2001).

In addition to these areas of caution, it must be pointed out that several findings from this study also provide hope and optimism for the success of students with variable levels of ADHD symptoms. First, and contrary to other reports, the ADHD clinical group did not show dire negative academic outcomes as has been reported in the literature. Further, although this sample was not burdened by severe executive dysfunction, members also reported learning to implement several adaptive coping approaches that were shown to relate positively with their academic performance and negatively to their academic difficulties. This was disproportionately true for the ADHD groups. At the

same time, there is reason to question just how skilled they are at academic coping, as it seems unlikely that their coping cannot benefit from further improvement. This possibility may provide further optimism for these undergraduates' scholastic potential.

TABLES AND FIGURES

Table 1

List of Attention-Deficit/Hyperactivity Disorder (ADHD) Symptoms Comprising DSM-IV Diagnostic Criteria

A. Either (1) or (2)

1. Six (or more) of the following symptoms of inattention have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level:

Inattention

a. Often fails to give close attention to details or makes careless mistakes in school, work, or other activities.
b. Often has difficulties sustaining attention in tasks or play activities.
c. Often does not seem to listen when spoken to directly.
d. Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behavior or failure to understand instructions).
e. Often has difficulty organizing tasks and activities.
f. Often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework).
g. Often loses things necessary for tasks or activities (e.g., toys, school assignments, pencils, books, or tools).
h. Is often distracted by extraneous stimuli.
i. Is often forgetful in daily activities.

(continued)

2. Six (or more) of the following symptoms of hyperactivity/impulsivity have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level:

Hyperactivity

a. Often fidgets with hands or feet or squirms in seat.
b. Often leaves seat in classroom or in other situations in which remaining seated is expected.
c. Often runs about or climbs excessively in situations where it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness).
d. Often has difficulty playing or engaging in leisure activities quietly.
e. Is often "on the go" or often acts as if "driven by a motor."
f. Often talks excessively.

Impulsivity

g. Often blurts out answers before questions have been completed.
h. Often has difficulty awaiting turn.
i. Often interrupts others or intrudes on others (e.g., butts into conversations or games).

B. Some hyperactive-impulsive or inattentive symptoms that caused impairment were present before age 7 years.
C. Some impairment from the symptoms is present in two or more settings (e.g., at school [or work] and at home).
D. There must be clear evidence of clinically significant impairment in social, academic, or occupational functioning.
E. The symptoms do no occur exclusively during the course of a Pervasive Developmental Disorder, Schizophrenia, or other psychotic Disorder and are not better accounted for by another metnal disorder (e.g., Mood Disorder, Anxiety Disorder, Dissociative Disorder, or a Personality Disorder).

Table 2

Summary of Measures

Variable	Dependent Measure	Purpose of assessment
Executive Function		
1. Paced Auditory Serial Addition Test (PASAT)	Total correct across trials	Working memory and processing speed
2. D-KEFS Tower Task	Total achievement score	Planful problem solving
Academic Coping		
1. Survey of Academic Coping Strategies (General)	Total score (0 - 175)	Broad academic coping strategy use
2. Survey of Academic Coping Strategies (Specific)	Total score (≤ 0 - 360)	Specific academic coping behavior use
ADHD Behavioral Symptoms		
1. Current Symptom Scale	Total score (0-18)	Current ADHD symptoms
2. Childhood Symptom Scale	Total score (0-18)	Childhood ADHD symptoms
Academic Outcome (Concurrent and Cumulative)		
1. Grade Point Average	University GPA	Academic performance
2. Problem Credit Hours	Sum of withdrawn, incomplete, etc.	Academic difficulties
3. Completed Credit Hours	Sum of all passed credit hours	Academic productivity
Exclusion		
1. Health History Questionnaire	Discrete rating (0-1)	Neurological or medical comorbidity
2. Beck Anxiety Inventory (BAI)	Total score (0-63)	Anxiety symptoms
3. Mood Assessment Scale (MAS)	Total score (0-30)	Depressive symptoms

Table 3

Means and Standard Deviations for Retrospective ADHD Symptoms in Childhood (N = 105)

	Diagnostic Group	
DSM-IV Symptom Checklist	Normative Control (*N* = 84) *mean* (*SD*)	Childhood ADHD (*N* = 21) *mean* (*SD*)
Childhood ADHD Symptoms:		
1. Inattentive	.81 (1.33)	6.0 (2.28)
2. Hyperactive-Impulsive	1.17 (1.45)	5.81 (1.89)
3. Total	1.98 (2.39)	11.81 (3.30)

Table 4

Means and Standard Deviations for Concurrent ADHD Symptoms in Adulthood (N = 101)

	Diagnostic Group	
DSM-IV Symptom Checklist	Normative Control (*N* = 83) *mean* (*SD*)	Adult ADHD (*N* = 18) *mean* (*SD*)
Adult ADHD Symptoms:		
1. Inattentive	.72 (1.21)	5.56 (2.21)
2. Hyperactive-Impulsive	.95 (1.09)	4.44 (1.85)
3. Total	1.67 (1.98)	10.11 (3.43)

Table 5

Distribution of Demographic Variables Across Childhood Normative Control and ADHD Groups (N = 105)

	Diagnostic Group					
	Normative	Childhood	Childhood ADHD Subtypes			
	Control	ADHD	Inattentive	Hyperactive-Impulsive	Combined	Not Otherwise Specified
Variable	(*N* = 84)	(*N* = 21)	(*N* = 2)	(*N* = 1)	(*N* = 10)	(*N* = 8)
Gender:						
1. Male (*N* = 45)	37	8	0	0	4	4
2. Female (*N* = 60)	50	13	2	1	6	4
Ethnicity:						
1. White (*N* = 63)	44	13	2	1	7	3
2. Hispanic (*N* = 33)	28	5	0	0	1	4
3. Black (*N* = 2)	2	0	0	0	0	0
4. Asian (*N* = 6)	5	1	0	0	0	1
5. Other (*N* = 7)	5	2	0	0	2	0

Table 6

Distribution of Continuous Demographic Variables Across Childhood Normative Control and ADHD Groups (N = 105)

	Diagnostic Group					
	Normative	Childhood	Childhood ADHD Subtypes			
	Control	ADHD	Inattentive	Hyperactive-Impulsive	Combined	Not Otherwise Specified
Variable	(*N* = 84)	(*N* = 21)	(*N* = 2)	(*N* = 1)	(*N* = 10)	(*N* = 8)
Age:						
1. 18 (*N* = 70)	56	14	2	0	6	6
2. 19 (*N* = 29)	23	6	0	1	3	2
3. 20 (*N* = 6)	5	1	0	0	1	0
Year in School:						
1. First (*N* = 83)	68	15	2	0	6	7
2. Second (*N* = 22)	16	6	0	1	4	1
SES (Parent Education):						
High School Graduates						
1. Zero Parents (*N* = 5)	4	1	0	0	1	0
2. One Parent (*N* = 1)	1	0	0	0	0	0
3. Two Parents (*N* = 7)	5	2	0	0	1	1
Undergraduate Study						
4. One Parent (*N* = 16)	14	2	0	0	1	1
Undergraduate Degree						
5. One Parent (*N* = 36)	29	7	1	0	3	3
Post-Graduate Study						
6. One Parent (*N* = 40)	31	9	1	1	4	3

Table 7

Distribution of Diagnostic Historical Variables Across Childhood Normative Control and ADHD Groups (N = 105)

	Diagnostic Group					
	Normative	Childhood	Childhood ADHD Subtypes			
Variable	Control ($N = 84$)	ADHD ($N = 21$)	Inattentive ($N = 2$)	Hyperactive-Impulsive ($N = 1$)	Combined ($N = 10$)	Not Otherwise Specified ($N = 8$)
ADHD Diagnosis:						
1. None ($N = 94$)	84	10	0	1	4	5
2. Prior Diagnosis ($N = 11$)	0	11	2	0	6	3
Prescription Treatment:						
Days per Week						
1. Not Applicable ($N = 98$)	84	14	0	1	5	8
2. Less Than Two ($N = 3$)	0	3	0	0	3	0
3. Two ($N = 1$)	0	1	0	0	1	0
4. Three to Five ($N = 1$)	0	1	1	0	0	0
5. Five or More ($N = 2$)	0	2	1	0	1	0

Table 8

Distribution of Demographic Variables Across Adult Normative Control and ADHD Groups (N = 101)

	Diagnostic Group					
	Normative	Adult	Adult ADHD Subtypes			
	Control	ADHD	Inattentive	Hyperactive-Impulsive	Combined	Not Otherwise Specified
Variable	(*N* = 83)	(*N* = 18)	(*N* = 2)	(*N* = 0)	(*N* = 3)	(*N* = 12)
Gender:						
1. Male (*N* = 43)	37	6	1	0	1	4
2. Female (*N* = 58)	46	12	1	0	2	8
Ethnicity:						
1. White (*N* = 55)	44	11	1	0	3	8
2. Hispanic (*N* = 32)	28	4	1	0	0	3
3. Black (*N* = 2)	2	0	0	0	0	0
4. Asian (*N* = 5)	5	0	0	0	0	0
5. Other (*N* = 7)	5	2	0	0	0	2

Table 9

Distribution of Continuous Demographic Variables Across Adult Normative Control and ADHD Groups (N = 101)

	Diagnostic Group					
	Normative	Adult	Adult ADHD Subtypes			
Variable	Control (N = 83)	ADHD (N = 18)	Inattentive (N = 2)	Hyperactive-Impulsive (N = 0)	Combined (N = 3)	Not Otherwise Specified (N = 12)
Age:						
1. 18 (N = 67)	56	11	1	0	1	8
2. 19 (N = 28)	22	6	1	0	2	3
3. 20 (N = 6)	5	1	0	0	0	1
Year in School:						
1. First (N = 81)	68	13	1	0	1	10
2. Second (N = 20)	15	5	1	0	2	2
SES (Parent Education):						
High School Graduates						
1. Zero Parents (N = 5)	4	1	0	0	0	1
2. One Parent (N = 1)	1	0	0	0	0	0
3. Two Parents (N = 7)	5	2	0	0	0	2
Undergraduate Study						
4. One Parent (N = 16)	14	2	0	0	0	2
Undergraduate Degree						
5. One Parent (N = 3)	28	7	1	0	2	3
Post-Graduate Study						
6. One Parent (N = 37)	31	6	1	0	1	4

Table 10

Distribution of Diagnostic Historical Variables Across Adult Normative Control and ADHD Groups (N = 101)

	Diagnostic Group					
	Normative	Adult	Adult ADHD Subtypes			
	Control	ADHD	Inattentive	Hyperactive-Impulsive	Combined	Not Otherwise Specified
Variable	(*N* = 83)	(*N* = 18)	(*N* = 2)	(*N* = 0)	(*N* = 3)	(*N* = 12)
ADHD Diagnosis:						
1. None (*N* = 91)	83	8	0	0	1	6
2. Prior Diagnosis (*N* = 10)	0	10	2	0	2	6
Prescription Treatment:						
Days per Week						
1. Not Applicable (*N* = 93)	83	0	1	0	1	7
2. Less Than Two (N = 3)	0	3	0	0	0	30
3. Two (*N* = 1)	0	1	0	0	1	0
4. Three to Five (*N* = 2)	0	1	1	0	0	1
5. Five or More (*N* = 2)	0	2	0	0	1	1

Table 11

Zero-Order Correlations for Total Sample Childhood ADHD Symptoms with Emotion Regulation Indices (N = 111)

	Emotion Regulation		
Childhood ADHD Symptoms	Depression Symptoms (MAS)	Depression Symptoms (MAS – ADHD Symptoms)	Anxiety Symptoms (BAI)
1. Inattentive	.43**	.37**	.19*
2. Hyperactive-Impulsive	.43**	.36**	.36**
3. Total	47**	.39**	.29**

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 12

Zero-Order Correlations for Total Sample Adult ADHD Symptoms with Emotion Regulation Indices (N = 111)

	Emotion Regulation		
Adult ADHD Symptoms	Depression Symptoms (MAS)	Depression Symptoms (MAS – ADHD Symptoms)	Anxiety Symptoms (BAI)
1. Inattentive	.52**	.44**	.45**
2. Hyperactive-Impulsive	.42**	.35**	.35**
3. Total	.51**	.43**	.43**

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 13

Zero-Order Correlations for Childhood Normative Control ADHD Symptoms with Emotion Regulation (N = 84)

	Emotion Regulation		
Childhood ADHD Symptoms	Depression Symptoms (MAS)	Depression Symptoms (MAS – ADHD Symptoms)	Anxiety Symptoms (BAI)
1. Inattentive	.15	.11	.10
2. Hyperactive-Impulsive	.16	.10	.28*
3. Total	.18	.12	.22*

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 14

Zero-Order Correlations for Adult Normative Control ADHD Symptoms with Emotion Regulation (N = 83)

	Emotion Regulation		
Adult ADHD Symptoms	Depression Symptoms (MAS)	Depression Symptoms (MAS – ADHD Symptoms)	Anxiety Symptoms (BAI)
1. Inattentive	.34**	.22*	.46**
2. Hyperactive-Impulsive	.16	.08	.27*
3. Total	.30**	.18	.43**

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 15

ANOVA for Childhood ADHD Syndrome Status across Emotion Regulation Indices (N = 105)

Source		Sum of Squares	df	Mean Square	*F*	*p*-value
MAS	Between Groups	442.29	1	442.29	27.58	.01
	Within Groups	1651.56	103	16.04		
	Total	2093.85	104			
MAS (– ADHD Symptoms)	Between Groups	180.06	1	180.06	18.46	.01
	Within Groups	1004.7	103	9.75		
	Total	1184.76	104			
BAI	Between Groups	260.86	1	260.86	7.19	.01
	Within Groups	3739.66	103	36.31		
	Total	4000.51	104			

Table 16

ANOVA for Adult ADHD Syndrome Status across Emotion Regulation Indices (N = 101)

Source		Sum of Squares	df	Mean Square	*F*	*p*-value
MAS	Between Groups	382.28	1	382.28	24.16	.01
	Within Groups	1566.77	99	15.83		
	Total	1949.05	100			
MAS (– ADHD Symptoms)	Between Groups	150.91	1	150.91	15.51	.01
	Within Groups	963.6	99	9.73		
	Total	1114.52	100			
BAI	Between Groups	380.07	1	380.07	10.82	.01
	Within Groups	3478.88	99	35.14		
	Total	3858.95	100			

Table 17

Zero-Order Correlations for Total Sample Emotion Regulation Ratings with Concurrent Academic Outcome (N = 111)

	Concurrent Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Emotion Regulation			
1. MAS	.01	.21*	–.04
2. MAS (− ADHD Symptoms)	.02	.22*	–.10
3. BAI	– .18	.27**	–.05

*p < .05 for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 18

Zero-Order Correlations for Total Sample Emotion Regulation Ratings with Cumulative Academic Outcome (N = 111)

	Cumulative Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Emotion Regulation			
1. MAS	.01	.14	–.02
2. MAS (– ADHD Symptoms)	.01	.12	–.01
3. BAI	–.09	.27**	–.05

*p < .05 for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 19

Zero-Order Correlations for Childhood Normative Control Emotion Regulation with Concurrent Academic Outcome (N = 84)

	Concurrent Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Emotion Regulation			
1. MAS	.02	.10	–.05
2. MAS (– ADHD Symptoms)	.05	.08	–.10
3. BAI	–.22*	.27*	.09

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 20

Zero-Order Correlations for Childhood ADHD Emotion Regulation with Concurrent Academic Outcome (N = 21)

	Concurrent Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Emotion Regulation			
1. MAS	–.12	.48*	.17
2. MAS (– ADHD Symptoms)	–.09	.55*	.10
3. BAI	–.14	.31	–.29

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 21

Zero-Order Correlations for Adult Normative Control Emotion Regulation with Concurrent Academic Outcome (N = 83)

	Concurrent Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Emotion Regulation			
1. MAS	.02	.10	–.05
2. MAS (– ADHD Symptoms)	.04	.08	–.10
3. BAI	–.22*	.26*	.09

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 22

Zero-Order Correlations for Adult ADHD Emotion Regulation with Concurrent Academic Outcome (N = 18)

	Concurrent Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Emotion Regulation			
1. MAS	–.11	.54*	.08
2. MAS (– ADHD Symptoms)	–.18	.62*	–.01
3. BAI	–.20	.27	–.09

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 23

Zero-Order Correlations for Childhood Normative Control Emotion Regulation with Cumulative Academic Outcome (N = 84)

	Cumulative Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Emotion Regulation			
1. MAS	.01	.13	–.03
2. MAS (– ADHD Symptoms)	.02	.08	–.01
3. BAI	–.09	.25*	–.12

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 24

Zero-Order Correlations for Childhood ADHD Emotion Regulation with Cumulative Academic Outcome (N = 21)

	Cumulative Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Emotion Regulation			
1. MAS	–.07	.39	.18
2. MAS (– ADHD Symptoms)	–.09	.45*	.08
3. BAI	–.14	.47*	.13

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 25

Zero-Order Correlations for Adult Normative Control Emotion Regulation with Cumulative Academic Outcome (N = 83)

	Cumulative Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Emotion Regulation			
1. MAS	.01	.13	–.04
2. MAS (– ADHD Symptoms)	.02	.07	–.01
3. BAI	–.10	.25*	–.12

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 26

Zero-Order Correlations for Adult ADHD Emotion Regulation with Cumulative Academic Outcome (N = 18)

	Cumulative Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Emotion Regulation			
1. MAS	–.18	.46	.13
2. MAS (– ADHD Symptoms)	–.21	.53*	.03
3. BAI	–.09	.43	.23

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 27

Zero-Order Correlations, Means, & Standard Deviations for Total Sample Childhood ADHD Symptoms (N = 111)

Variable	1	2	3	*M*	*SD*
Childhood ADHD Symptoms					
1. Inattentive	—	.76	.94	1.87	2.56
2. Hyperactive-Impulsive		—	.93	2.07	2.36
3. Total			—	3.95	4.62

Table 28

Zero-Order Correlations, Means, & Standard Deviations for Normative Control Childhood ADHD Symptoms (N = 84)

Variable	1	2	3	*M*	*SD*
Childhood ADHD Symptoms					
1. Inattentive	—	.48	.85	.81	1.33
2. Hyperactive-Impulsive		—	.87	1.17	1.45
3. Total			—	1.98	2.39

Table 29

Zero-Order Correlations, Means, & Standard Deviations for ADHD Group Childhood ADHD Symptoms (N = 21)

Variable	1	2	3	*M*	*SD*
Childhood ADHD Symptoms					
1. Inattentive	—	.24	.83	6.00	2.28
2. Hyperactive-Impulsive		—	.74	5.81	1.89
3. Total			—	11.81	3.30

Table 30

Zero-Order Correlations, Means, & Standard Deviations for Total Sample Adult ADHD Symptoms (N = 111)

Variable	1	2	3	*M*	*SD*
Adult ADHD Symptoms					
1. Inattentive	—	.74	.95	1.65	2.27
2. Hyperactive-Impulsive		—	.92	1.65	1.86
3. Total			—	3.32	3.90

Table 31

Zero-Order Correlations, Means, & Standard Deviations for Normative Control Adult ADHD Symptoms (N = 83)

Variable	1	2	3	*M*	*SD*
Adult ADHD Symptoms					
1. Inattentive	—	.48	.88	.72	1.21
2. Hyperactive-Impulsive		—	.84	.95	1.09
3. Total			—	1.67	1.98

Table 32

Zero-Order Correlations, Means, & Standard Deviations for ADHD Group Adult ADHD Symptoms (N = 18)

Variable	1	2	3	*M*	*SD*
Adult ADHD Symptoms					
1. Inattentive	—	.35	.85	5.56	2.20
2. Hyperactive-Impulsive		—	.79	4.44	1.85
3. Total			—	10.11	3.43

Table 33

Zero-Order Correlations, Means, and Standard Deviations for Total Sample Concurrent Academic Outcome (N = 111)

Variable	1	2	3	*M*	*SD*
Concurrent Academic Outcome					
1. Grade Point Average	—	–.59	–.02	3.00	.87
2. Problem Credit Hours		—	.03	1.29	2.48
3. Completed Credit Hours			—	12.63	2.55

Table 34

Zero-Order Correlations, Means, and Standard Deviations for Total Sample Cumulative Academic Outcome (N = 111)

Variable	1	2	3	*M*	*SD*
Cumulative Academic Outcome					
1. Grade Point Average	—	–.71	.32	3.03	.69
2. Problem Credit Hours		—	–.19	4.73	6.93
3. Completed Credit Hours			—	53.66	11.17

Table 35

Zero-Order Correlations, Means, and Standard Deviations for Total Sample Academic Coping Indices (N = 111)

Variable	1	2	3	*4*	*M*	*SD*
Academic Coping						
1. Strategies	—	.82	.25	.35	.63	.17
2. Behaviors		—	.15	–.24	.47	.16
3. Maladaptive Behaviors			—	.18	.49	.18
4. Discrepancy				—	.16	.10

Table 36

Zero-Order Correlations, Means, and Standard Deviations for Total Sample Executive Function Indices (N = 111)

Variable	1	2	*M*	*SD*
Executive Function				
1. Planful Problem-Solving (TOH)	—	.39	19.06	3.95
2. Attentional Control (PASAT)		—	118.05	37.23

Table 37

Zero-Order Correlations, Means, and Standard Deviations for Total Sample Emotional Regulation Indices (N = 111)

Variable	1	2	3	*M*	*SD*
Emotional Regulation					
1. MAS	—	.95	.59	6.75	4.43
2. MAS (– ADHD Symptoms)		—	.53	4.09	3.33
3. BAI			—	7.43	6.27

Table 38

Zero-Order Correlations for Total Sample Adult ADHD Symptoms with Concurrent Academic Outcome (N = 111)

	Concurrent Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Adult ADHD Symptoms			
1. Inattentive	–.21*	.31*	–.14
2. Hyperactive-Impulsive	–.07	.13	–.15
3. Total	–.15	.24*	–.16*

*$p < .05$ for one-tailed pearson correlation.

**p < .01 for one-tailed pearson correlation.

Table 39

Zero-Order Correlations for Normative Control Adult ADHD Symptoms with Concurrent Academic Outcome (N = 83)

	Concurrent Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Adult ADHD Symptoms			
1. Inattentive	–.41**	.43**	.04
2. Hyperactive-Impulsive	–.11	.11	–.10
3. Total	–.31**	.32**	–.03

*$p < .05$ for one-tailed pearson correlation.

**p < .01 for one-tailed pearson correlation.

Table 40

Standardized Coefficients for Total Sample Adult ADHD Symptoms^a (N = 111)

		Unstandardized Coefficients		Standardized Coefficients		
Model		*ß*	Std. Error	*ß*	*t*	*p*-value
1	(Constant)	3.07	.11		28.3	.01
	Adult ADHD Inattentive Symptoms	–.14	.05	–.35	–2.6	.01
	Adult ADHD Hyperactive-Impulsive Symptoms	.00	.07	.20	1.41	.16

a. Dependent Variable: Concurrent GPA

Table 41

Standardized Coefficients for Total Sample Adult ADHD Symptoms^b (N = 111)

Model		Unstandardized Coefficients		Standardized Coefficients		
		ß	Std. Error	*ß*	*t*	*p*-value
1	(Constant)	.92	.30		3.08	.01
	Adult ADHD Inattentive Symptoms	.51	.15	.46	3.44	.01
	Adult ADHD Hyperactive-Impulsive Symptoms	.00	.18	–.21	–1.6	.12

b. Dependent Variable: Concurrent Problem Credit Hours

Table 42

Zero-Order Correlations for Total Sample Adult ADHD Symptoms with Cumulative Academic Outcome (N = 111)

	Cumulative Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Adult ADHD Symptoms			
1. Inattentive	–.15	.18*	–.16*
2. Hyperactive-Impulsive	–.03	.04	–.06
3. Total	–.10	.12	–.12

**p* < .05 for one-tailed pearson correlation.

***p < .01 for one-tailed pearson correlation.

Table 43

Zero-Order Correlations for Normative Control Adult ADHD Symptoms with Cumulative Academic Outcome (N = 83)

	Cumulative Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Adult ADHD Symptoms			
1. Inattentive	–.28**	.35**	–.06
2. Hyperactive-Impulsive	–.04	.06	.09
3. Total	–.19	.25*	.02

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 44

Standardized Coefficients for Total Sample Adult ADHD Symptoms^c (N = 111)

	Unstandardized Coefficients		Standardized Coefficients		
Model	*ß*	Std. Error	*ß*	*t*	*p*-value
1 (Constant)	4.34	.87		5	.01
Adult ADHD Inattentive Symptoms	.99	.43	.33	2.33	.02
Adult ADHD Hyperactive-Impulsive Symptoms	.00	.52	–.20	–1.5	.15

c. Dependent Variable: Cumulative Problem Credit Hours

Table 45

Zero-Order Correlations for Total Sample Academic Coping Ratings with Concurrent Academic Outcome (N = 111)

	Concurrent Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Academic Coping			
1. Strategies	.26**	–.08	–.28**
2. Behaviors	.11	–.05	–.12
3. Maladaptive Behaviors	.01	.12	–.40**
4. Discrepancy	.26**	–.04	–.26**

*p < .05 for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 46

Zero-Order Correlations for Child Normative Control Academic Coping with Concurrent Academic Outcome (N = 84)

	Concurrent Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Academic Coping			
1. Strategies	.19	.01	–.22*
2. Behaviors	.00	.07	–.11
3. Maladaptive Behaviors	.01	.12	–.34**
4. Discrepancy	.34**	–.10	–.16

*p < .05 for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 47

Zero-Order Correlations for Child ADHD Academic Coping with Concurrent Academic Outcome (N = 21)

	Concurrent Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Academic Coping			
1. Strategies	.41	–.21	–.49*
2. Behaviors	.46*	–.35	–.16
3. Maladaptive Behaviors	–.10	.20	–.51*
4. Discrepancy	–.01	.14	–.49*

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 48

Zero-Order Correlations for Adult Normative Control Academic Coping with Concurrent Academic Outcome (N = 83)

	Concurrent Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Academic Coping			
1. Strategies	.18	.00	–.23*
2. Behaviors	–.01	.06	–.12
3. Maladaptive Behaviors	.01	.12	–.34**
4. Discrepancy	.34**	–.11	–.16

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 49

Zero-Order Correlations for Adult ADHD Academic Coping with Concurrent Academic Outcome (N = 18)

	Concurrent Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Academic Coping			
1. Strategies	.58*	–.35	–.26
2. Behaviors	.52*	–.37	–.03
3. Maladaptive Behaviors	–.05	.07	–.45
4. Discrepancy	.11	.02	–.33

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 50

Zero-Order Correlations for Total Sample Academic Coping Ratings with Cumulative Academic Outcome (N = 111)

	Cumulative Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Academic Coping			
1. Strategies	.30*	–.12	.21*
2. Behaviors	.12	–.08	.21*
3. Maladaptive Behaviors	–.06	–.10	.04
4. Discrepancy	.19	–.08	.02

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 51

Zero-Order Correlations for Child Normative Control Academic Coping with Cumulative Academic Outcome (N = 84)

	Cumulative Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Academic Coping			
1. Strategies	.17	–.07	.18
2. Behaviors	.04	.02	.15
3. Maladaptive Behaviors	–.06	.13	.08
4. Discrepancy	.23*	–.14	.06

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 52

Zero-Order Correlations for Child ADHD Academic Coping with Cumulative Academic Outcome (N = 21)

	Cumulative Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Academic Coping			
1. Strategies	.33	–.31	.32
2. Behaviors	.45*	–.52*	.40
3. Maladaptive Behaviors	–.25	.15	–.14
4. Discrepancy	–.11	.23	– .05

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 53

Zero-Order Correlations for Adult Normative Control Academic Coping with Cumulative Academic Outcome (N = 83)

	Cumulative Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Academic Coping			
1. Strategies	.17	–.06	.19
2. Behaviors	.04	.02	.16
3. Maladaptive Behaviors	–.06	.13	.08
4. Discrepancy	.23*	–.14	.06

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 54

Zero-Order Correlations for Adult ADHD Academic Coping with Cumulative Academic Outcome (N = 18)

	Cumulative Academic Outcome		
Variable	Grade Point Average	Problem Credit Hours	Completed Credit Hours
Academic Coping			
1. Strategies	.33	–.31	.32
2. Behaviors	.45*	–.52*	.40
3. Maladaptive Behaviors	–.25	.15	−.14
4. Discrepancy	–.11	.23	−.05

*$p < .05$ for two-tailed pearson correlation.

**p < .01 for two-tailed pearson correlation.

Table 55

Zero-Order Correlations for Total Sample Childhood ADHD Symptoms with Academic Coping (N = 111)

	Academic Coping			
Variable	Strategies	Behaviors	Maladaptive Behaviors	Discrepancy
Childhood ADHD Symptoms				
1. Inattentive	.05	.02	.20*	.05
2. Hyperactive-Impulsive	.02	–.03	.16	.07
3. Total	.04	–.01	.20*	.06

*$p < .05$ for two-tailed pearson correlation.

**$p < .01$ for two-tailed pearson correlation.

Table 56

Zero-Order Correlations for Total Sample Adult ADHD Symptoms with Academic Coping (N = 111)

	Academic Coping			
Variable	Strategies	Behaviors	Maladaptive Behaviors	Discrepancy
Adult ADHD Symptoms				
1. Inattentive	.09	–.01	.36**	.16
2. Hyperactive-Impulsive	.07	–.02	.24**	.14
3. Total	.09	–.02	.33**	.17

*$p < .05$ for two-tailed pearson correlation.

**$p < .01$ for two-tailed pearson correlation.

Table 57

Zero-Order Correlations for Child ADHD Ratings of Childhood ADHD Symptoms with Academic Coping (N = 21)

	Academic Coping			
Variable	Strategies	Behaviors	Maladaptive Behaviors	Discrepancy
Childhood ADHD Symptoms				
1. Inattentive	–.30	–.07	.48*	–.32
2. Hyperactive-Impulsive	–.24	–.27	.18	.01
3. Total	–.34	–.20	.43	–.22

*$p < .05$ for two-tailed pearson correlation.

**$p < .01$ for two-tailed pearson correlation.

Table 58

Zero-Order Correlations for Adult Normative Control Ratings of Adult ADHD Symptoms with Academic Coping (N = 83)

	Academic Coping			
Variable	Strategies	Behaviors	Maladaptive Behaviors	Discrepancy
Adult ADHD Symptoms				
1. Inattentive	–.20	–.11	.23*	–.17
2. Hyperactive-Impulsive	–.11	–.10	.20	–.04
3. Total	–.18	–.12	.25*	–.13

*$p < .05$ for two-tailed pearson correlation.

**$p < .01$ for two-tailed pearson correlation.

Table 59

Zero-Order Correlations for Adult ADHD Group Ratings of Adult ADHD Symptoms with Academic Coping (N = 18)

	Academic Coping			
Variable	Strategies	Behaviors	Maladaptive Behaviors	Discrepancy
Adult ADHD Symptoms				
1. Inattentive	–.06	–.03	.58*	–.03
2. Hyperactive-Impulsive	–.17	–.13	.19	–.07
3. Total	–.07	–.09	.48*	–.03

*$p < .05$ for two-tailed pearson correlation.

**$p < .01$ for two-tailed pearson correlation.

Table 60

ANOVA for Adult ADHD Syndrome Status Across Academic Coping Indices (N = 101)

Source		Sum of Squares	df	Mean Square	*F*	*p*-value
Strategies	Between Groups	.12	1	.12	4.66	.03
	Within Groups	2.52	99	.03		
	Total	2.64	100			
Behaviors	Between Groups	.01	1	.01	.29	.59
	Within Groups	2.67	99	.03		
	Total	2.68	100			
Maladaptive Behaviors	Between Groups	.19	1	.19	5.82	.02
	Within Groups	3.31	99	.03		
	Total	3.50	100			
Discrepancy	Between Groups	.06	1	.06	7.53	.01
	Within Groups	.81	99	.01		
	Total	.87	100			

Table 61

Zero-Order Correlations for Total Sample Ratings of Childhood ADHD Symptoms with Executive Function (N = 111)

	Executive Function	
Variable	TOH	PASAT
Childhood ADHD Symptoms		
1. Inattentive	–.11	–.24*
2. Hyperactive-Impulsive	–.12	–.21*
3. Total	–.12	–.24*

*$p < .05$ for two-tailed pearson correlation.

**$p < .01$ for two-tailed pearson correlation.

Table 62

Zero-Order Correlations for Total Sample Ratings of Adult ADHD Symptoms with Executive Function (N = 111)

	Executive Function	
Variable	TOH	PASAT
Adult ADHD Symptoms		
1. Inattentive	–.06	–.21*
2. Hyperactive-Impulsive	–.04	–.13
3. Total	–.05	–.08

*$p < .05$ for two-tailed pearson correlation.

**$p < .01$ for two-tailed pearson correlation.

Table 63

Standardized Coefficients for Total Sample Adult ADHD Symptoms and Depression Symptoms^b (N = 111)

Model		Unstandardized Coefficients		Standardized Coefficients		
		ß	Std. Error	*ß*	*t*	*P*-value
1	(Constant)	.56	.41		1.35	.18
	Adult ADHD Inattentive Symptoms	.30	.18	.27	2.54	.01
	Depression Symptoms (MAS)	.00	.06	.06	.60	.55

b. Dependent Variable: Concurrent Problem Credit Hours

Table 64

Standardized Coefficients for Total Sample Adult ADHD Symptoms and Non-overlapping Depression Symptoms^b (N = 111)

Model		Unstandardized Coefficients		Standardized Coefficients		
		ß	Std. Error	*ß*	*t*	*p*-value
1	(Constant)	.51	.36		1.4	.16
	Adult ADHD Inattentive Symptoms	.28	.11	.26	2.55	.01
	Depression Symptoms (MAS − ADHD Symptoms)	.00	.08	.10	1.03	.31

b. Dependent Variable: Concurrent Problem Credit Hours

Table 65

Standardized Coefficients for Total Sample Adult ADHD Symptoms and Anxiety Symptoms^b (N = 111)

	Unstandardized Coefficients		Standardized Coefficients		
Model	*β*	Std. Error	*β*	*t*	*p*-value
1 (Constant)	.39	.35		1.12	.27
Adult ADHD Inattentive Symptoms	.25	.11	.23	2.29	.02
Anxiety Symptoms (BAI)	.00	.04	.16	1.61	.11

b. Dependent Variable: Concurrent Problem Credit Hours

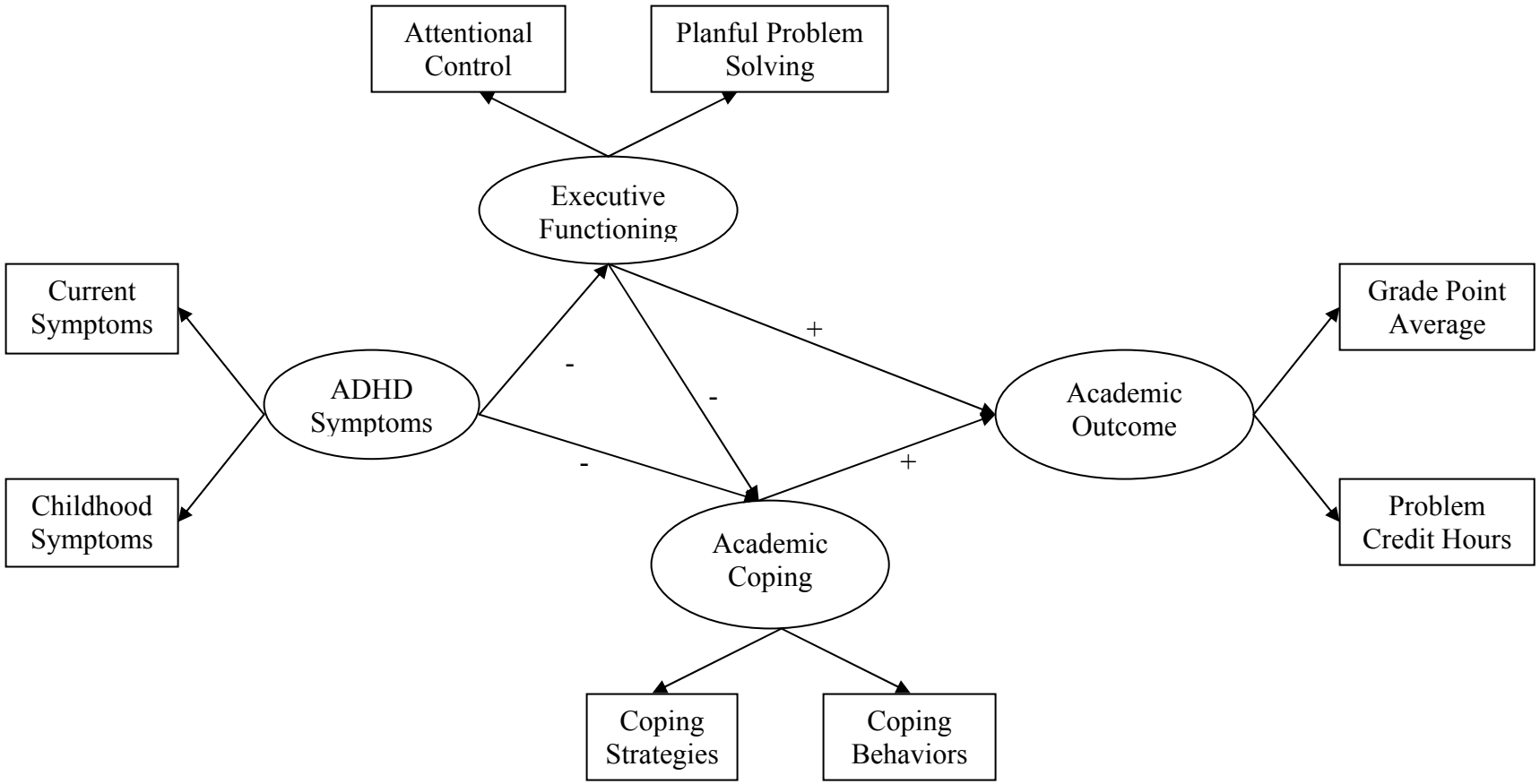

Figure 1. An Integrative Model of ADHD Symptoms and Academic Outcome

Figure 1 shows the structural model of the proposed relationships, where ellipses represent latent or hypothetical constructs and rectangles represent observed variables. The structural model is the part of the model that involves the constructs of interest and the links between those constructs. The links between the latent variables and the observed variables are referred to as the measurement model, and represent a confirmatory factor model.

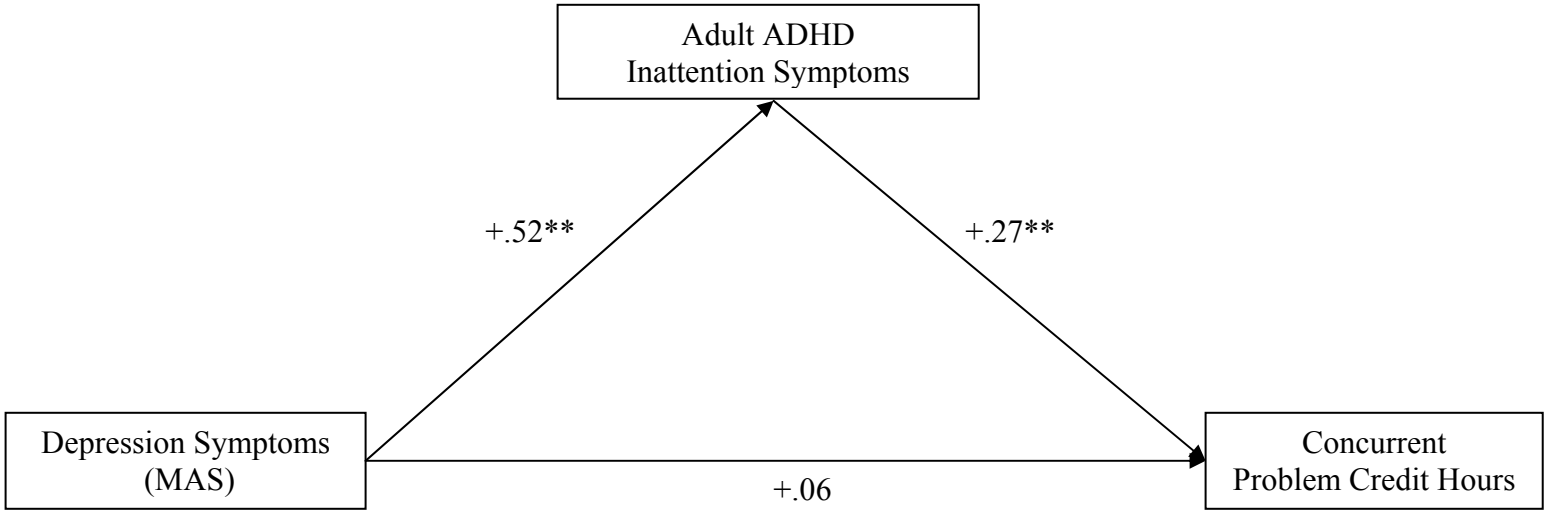

Figure 2. A Model of Mediation for Depression and Adult ADHD Inattention Symptoms with Academic Outcome
*$p < .05$, **$p < .01$.

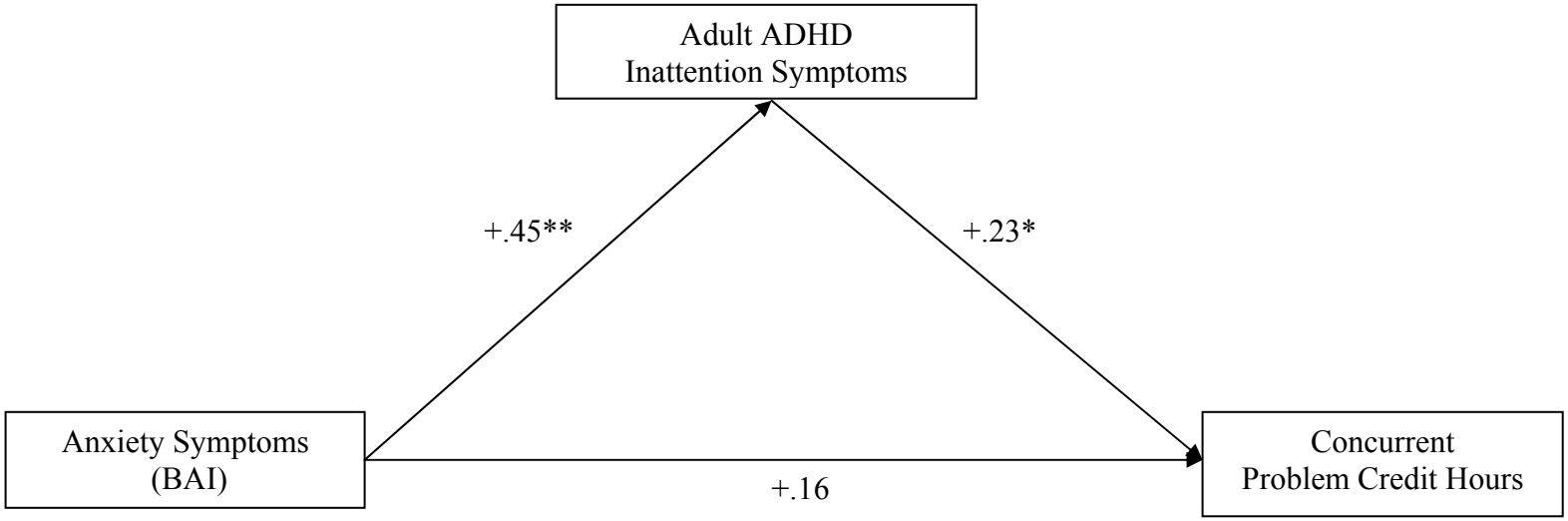

Figure 3. A Model of Mediation for Anxiety and Adult ADHD Inattention Symptoms with Academic Outcome
*$p < .05$, **$p < .01$.

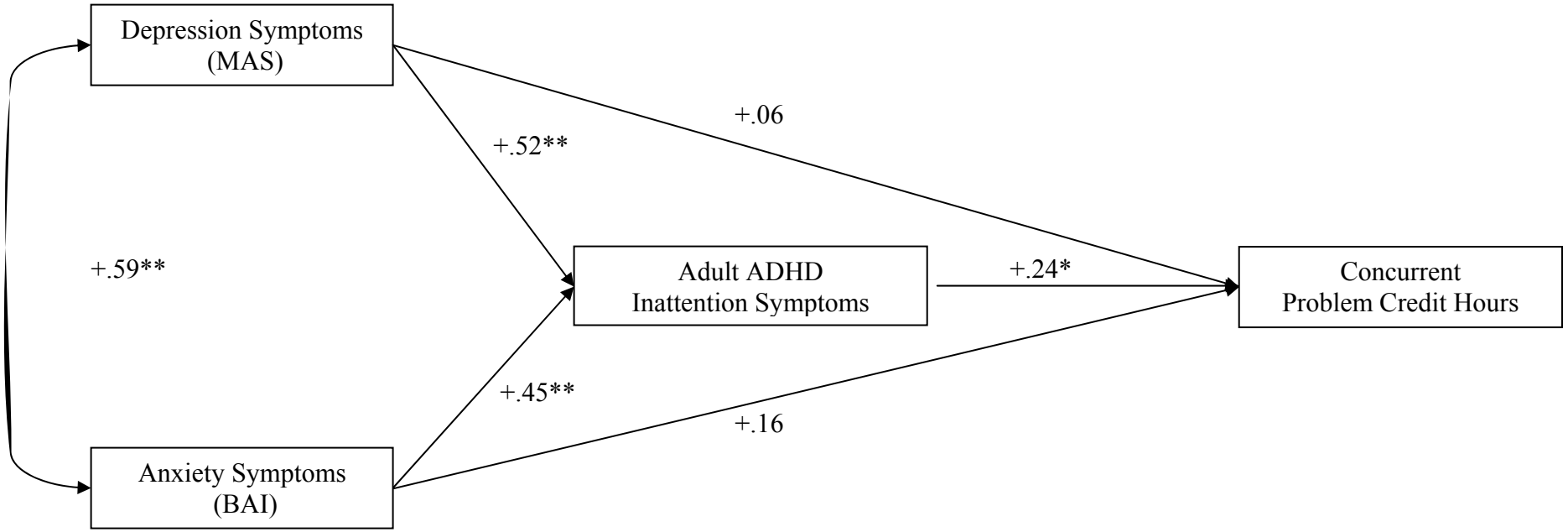

Figure 4. An Integrative Model of Mediation for Emotion Regulation, Adult ADHD Inattention Symptoms and Academic Outcome
*$p < .05$, **$p < .01$.

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